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VETERINARY JOURNAL

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Editorial

THE PROGRESS OF VETERINARY SURGERY.

THE case which we publish in this month's issue, in which the heart of a cow has been surgically operated upon for the extraction of a foreign body (and in which the animal has made a satisfactory recovery), is one to which we draw the particular attention of our readers, as it is more pioneer work which shows what progress has been made of recent years in the surgical branch of our science. It is one thing to operate on a small animal in a laboratory, and another thing to operate on a naturally affected case under the much more difficult conditions of field work; and the article which Mr. Pugh has written will form a big flagstone in the foundations of an edifice which the younger generation of men must build up. The finer surgery of the horse and dog is easy when compared with that of the animals of the farm proper, for the risk of after-contamination of the wound in these is much greater; and they are not so easily restrained or used to being kept in any one position. Besides which, it is much more difficult to keep their surroundings hygienically clean. One often wonders when performing a major operation on a farm animal, what a Harley Street surgeon would think if asked to do his work under similar conditions. His first impressions would certainly be that to attain a successful result was a practical impossibility; and that the veterinarian, with all his disadvantages of not having clean sheets, and nice nurses to attend to his patients afterwards, can open body cavities without the sequel of septic infection is really (when considered from a theoretical point of view) very often little short of marvellous.

FIELD DISTEMPER FUND.

In the Medical Research Council Report for the year ending September 30, 1924, allusion is made to the research into distemper of the dog which has been entrusted to the Council by the Field Distemper Fund; and readers of the Veterinary Journal, who have been foremost among the supporters of the Fund, are naturally watching (and hoping for) results which will be of practical assistance in combating this canine scourge.

An elaborate isolation breeding compound has been built and special laboratory and hospital accommodation buildings for this research have been added to those already there. The bacteriological investigation of the virus has (according to the Report) been placed in the hands of Dr. W. E. Gye and Dr. P. P. Laidlaw, whilst our colleague Mr. G. W. Dunkin, M.R.C.V.S., is responsible for the general hygienic management and control of the animals and the kennels; it being stated that they have the co-operation of the workers in the National Institute at Hampstead (Mr. J. E. Barnard, F.R.S., and Mr. C. Dobell, F.R.S., being specifically named); and the bacteriological work done during the year by Mr. R. E. Glover, M.R.C.V.S., on a series of infected dogs, receives mention.

Apparently the work has now started in earnest, and the subscribers will await further reports with interest.

General Articles

INFECTIOUS ABORTION OF CATTLE. NOTES ON AGGLUTINATION.

By L. E. W. BEVAN, M.R.C.V.S.,
Director of Veterinary Research, Southern Rhodesia.

For some years the Veterinary Research Department of Southern Rhodesia has prepared and issued for the protection of animals against infectious abortion a vaccine known as the "de-vitalised" vaccine, a name coined to distinguish it from the so-called "live" and "dead" vaccines applied elsewhere.

This vaccine was prepared from cultures of a pathogenic strain of *Bacillus abortus* agglutinable by serum obtained from natural cases of infection. The agglutinating power of the organism was considered an essential feature, no culture being used for a vaccine unless it possessed this property. Massive cultures grown on solid media were washed off with saline and were then submitted to treatment with chloroform, this agent having been selected by reason of the

fact that while causing the rupture of the organism it does not destroy its toxins. It was considered that the vaccine prepared in this manner would possess more specific antigenic powers than those composed of organisms whose essential properties had been lost by frequent subcultivations, heat, or other means.

It may here be stated that no claim has ever been made that this vaccine possesses curative properties; indeed, in anything that has been said or written concerning it great care has been taken to point out that if an animal is infected with the disease and carries a dead or injured fœtus, or if the fœtal membranes are severely damaged, abortions must occur notwithstanding treatment. As the vaccine has been applied to all females in infected herds whether pregnant or otherwise, a number of abortions have inevitably occurred after inoculation, and these have in some cases been attributed to the vaccine. All that the vaccine was intended to do was to set up a temporary immunity in cattle in danger of infection until such time as the owners of the animals, with the assistance of the Veterinary Department, could determine the source of infection and remove it.

It has been stated in the public Press that " the method adopted by Mr. Bevan is not new. It has been tried in Great Britain and most European countries on a very large scale " (*Farmers' Weekly*, Vol. xxi, No. 543); and elsewhere that " the so-called dead vaccine which is being employed in that country [Southern Rhodesia] has proved a failure in all European countries where it has been tried." These statements, emanating from a very responsible source, were misleading in view of the fact that the method of preparing the vaccine originated at this laboratory, and, as far as we know, has never been applied outside Southern Rhodesia. The writers of these statements confused the " de-vitalised " vaccine with the " dead " vaccine, although the name was coined to draw attention to the essential difference between the two.

Such criticisms have, unfortunately, to some extent discredited the vaccine and have encouraged the unscrupulous to actually charge it not only with failing to arrest the disease but also with giving rise to it. The fact that some hundreds of thousands of doses have been issued without untoward results is practical evidence against the latter contention, and, indeed, numerous reports received from owners of infected herds indicate that when properly applied the use of the vaccine was attended with excellent results. However, as revenue has been derived from its sale it was thought necessary to put its efficacy to the proof under laboratory conditions.

It was, therefore, decided to carry out experiments to determine whether the " de-vitalised " vaccine gave rise to any protection

against infectious abortion, and if so for how long. Unfortunately, as will be seen from the following notes, the results proved inconclusive as far as the above questions were concerned, but in the course of the investigation numerous careful observations were made resulting in valuable information which appears to be worthy of publication.

The subjects of the experiments were fourteen in-calf native Mashona cows obtained by the Native Commissioner of the Mrewas district. One of these gave birth to a calf on the journey to Salisbury. On arrival they were all tested by means of the agglutination test and two were found to react. This was disconcerting, because they were selected from an area considered to be free from the disease. During the course of the experiments it was found that the inoculation of material thought to be infective into these animals has not produced the expected abortion, and the question arises whether native stock may not possess some degree of resistance to the disease. It has been suggested that the disease may have existed in this country for very many years, and that native stock have to a large extent become immune to it; but, as the result of the introduction of foreign blood for the purpose of grading up, the disease has increased in virulence. This opinion has been opposed on the grounds that most of the better-bred herds which exist at the present time have been bred up from a foundation of native stock, and would not have arrived at their present numbers had infectious abortion existed. It may be pointed out that of the fourteen cows two only reacted, and if the others did possess any resistance it was not indicated by any agglutination reaction.

In order to determine whether any immunity resulted from the inoculation of the vaccine, it was first necessary to obtain a virus capable of causing abortion. For this purpose the following materials were used:

(1) A suspension of *B. abortus* cultivated at the Laboratory, Salisbury.

(2) A suspension of *B. abortus* obtained from the Royal Veterinary College, London. The history of the strain is that it had been isolated in 1923 by Sheather "via a guinea-pig from a sample of milk from an infected cow," and had been passed through nine generations in artificial culture. Two strains were sent, but one tube was contaminated on arrival. Strain No. 66 was subcultivated successfully and gave rise to massive cultures.

(3) A virus in the form of stomach contents of a fœtus which was aborted by Cow No. 62 on the ninetieth day after intravenous inoculation with virus No. 66.

Throughout the experiments it was decided to record the agglu-

tination titre of blood taken at short intervals, as it was thought that by this method some indication might be obtained as to the reaction following the injection of "de-vitalised" vaccine and the subsequent inoculation with the different forms of virus.

Although it is recognised that agglutinins are not synonymous with immunity, they probably are closely associated with it. Kolmer states that: ". . . At present agglutinins are regarded as playing a subsidiary rôle in immunity, their presence being of diagnostic value and the indication of the presence of more important factors, and as an aid to bacteriolysis and phagocytosis, as first shown by Besredka with guinea-pigs infected with typhoid bacilli. As shown by Bull experimentally, agglutination may occur *in vivo*, and the power of the blood to cause agglutination determines, in large measure, whether after their direct introduction in an experimental way the bacteria are to be removed promptly from the circulation and bacteremia avoided, or whether they are to remain and produce bacteremia. Micro-organisms which are not agglutinated in the normal rabbit may be able to do so by the intravenous injection of homologous immune serum, and this probably explains the rapid disappearance of pneumococci from the blood following the intravenous injections of homologous anti-pneumococcus serum. The bacterial clumps accumulate in the organs in which they are phagocyted. In all of Bull's investigations, including instances of both natural and passive immunity, the agglutination of bacteria in the blood of the infected animal was followed by phagocytosis and destruction of the bacteria in the viscera of the body with a subsequent disappearance of the bacteria from the blood-stream. It was observed, however, that when agglutination was incomplete a few micro-organisms remained in the blood, later to multiply and cause a fatal bacteremia. In this way it appears that agglutinins, opsonins, and phagocytosis are closely related and probably exert an important rôle in resistance to, and recovery from, infection."

In the course of these experiments many hundreds of tests have been made, a standard emulsion being used throughout and blood obtained in pipettes from the auricular veins, the serum being pipetted off from the clot and used on the day of collection. In this way results may be regarded as standardised and the reactions may be compared with one another.

1. Injection of Suspension of Local Strain.

It may be well to first consider the results of the intravenous inoculation of the organism cultivated at this laboratory. This was known to be virulent until recently, although *Cow No.* 38, inoculated

intravenously with 20 c.c. of a thick suspension, did not abort, but 199 days after gave birth to a healthy calf. It may here be remarked that for 43 days after the injection the blood of this cow did not agglutinate. On the 49th day, however, her agglutination index was 1/100, remaining fairly constant until the 143rd day, when it reacted 1/200, remaining at about the same level until the calf was born. On that day the agglutination index of the cow was 1/250, but strange to relate the index of the calf was as high as 1/400. On the 210th day the cow's index was still 1/250. On the 242nd day, i.e. the day of writing, the cow's index is less than 1/100, and that of the calf's 1/150. The fact that the serum of the calf agglutinated more powerfully than that of its mother at the time of birth and for some time after is an observation of some interest. Attention should also be drawn to the slow onset of agglutinins and the long persistence of a low agglutination titre which gradually died out after the birth of the calf. It would appear that the avirulent organism slowly established itself and did not for many weeks cause sufficient disturbance to give rise to agglutinins. Does this indicate what may be expected when so-called "live" vaccines are made up of living but non-virulent organisms?

It is also somewhat remarkable that 20 c.c. of a thick suspension of this organism injected intravenously should cause less agglutination than 5 c.c. or 20 c.c. of a similar suspension in the form of "devitalised" vaccine, i.e. after the organism had been treated with chloroform, when injected subcutaneously (*vide* Cases 39, 66, 40, and 67).

2. Injection or Suspension of Sheather's Strain.

The injection of 20 c.c. of a thick suspension of culture No. 66 into *Cow No.* 37 gave rise to no agglutinins for 7 days. On the 12th day, however, the agglutination index registered 1/150, and continued to increase until the 42nd day, when it reached 1/400. It continued to vary between 1/200 and 1/300 until the 245th day, when it was killed in the course of another experiment. About 60 days after the injection the external genitalia indicated that she was about to calve, but no fœtus or membranes were ever noticed. She subsequently became very thin and remained so for some weeks, but later improved and became quite fat. She showed no signs of œstrum until the 34th week. On post-mortem examination the uterine wall was found thickened and numerous small cotyledons were covered with a purulent material. It is probable that the cow aborted unnoticed.

A similar injection of 20 c.c. into the jugular vein of *Cow No.* 62

caused no agglutination until after the 7th day. The index reached 1/150 on the 14th day and 1/250 on the 43rd day. It remained at this level for some time, but gradually fell until the 86th day, when it stood at 1/150. On the 90th day the cow aborted a six-month-old calf and retained the after-birth. This was removed artificially, but a persistent discharge rendered her dangerous, and she was subsequently destroyed. The blood of the fœtus was tested and yielded an agglutination index 1/400. Its stomach contents were inoculated into two vaccinated animals, Nos. 39 and 67, and two control animals, Nos. 95 and 96. These will be referred to later.

3. Injection of "De-vitalised" Vaccine.

The usual dose of "de-vitalised" vaccine employed in practice is 5 c.c. subcutaneously, repeated at intervals of two months, three or more injections being recommended. It was thought desirable to ascertain whether the dose was sufficient and whether the "timing" was such as to maintain a well-marked agglutination. *Cow No.* 39 received 5 c.c. of "de-vitalised" vaccine. At the time of inoculation her blood contained no agglutinins, but 6 days after the titre had reached 1/150. On the 11th day it stood as high as 1/400, and gradually declined until the 42nd day. It then returned to 1/150, where it remained until the 63rd day, when a second dose of 5 c.c. was administered. Six days after the titre stood at 1/200, but 13 days later it had reached 1/300, where it remained with slight variations for 61 days. The cow was then inoculated with virus from the fœtus of No. 62, 15 days after which the titre recorded was 1/350; 35 days after it fell to 1/200, but 92 days after, i.e. the time of writing, it stands at 1/150. As previously stated, the cow has not yet aborted.

Cow No. 66 also received 5 c.c. of "de-vitalised" vaccine subcutaneously. On the 7th day after the titre recorded was 1/100, 14 days after which it reached 1/150, and remained there until the 28th day. On the 36th day it reached 1/250, and with slight variations continued at this level until the 71st day. It then commenced to fall to 1/150 on the 85th day, and reached 1/100 on the 127th day, after which it continued to fall until the 182nd day, when the cow gave birth to a healthy calf, the serum of which agglutinated 1/50, and continued to do so until the time of writing. This case is of importance as it shows that the agglutination reaction caused by vaccination will persist for a very considerable period. It is also of interest in that the calf possessed agglutinins after its mother had ceased to do so.

Cow No. 40 received 20 c.c. of "de-vitalised" vaccine subcutaneously. At the time of inoculation her blood caused no aggutination,

but on the 6th day the titre was 1/150, rising to 1/350 on the 28th day, after which it fell to 1/250 on the 42nd day, remaining at that level until the 55th day, and falling to 1/150 on the 63rd day. A further injection of 20 c.c. was then administered, and the index rose until it reached 1/500 on the 60th day after the second injection. A third inoculation of 20 c.c. was then given, 100 days after which the index stood at 1/200. This case shows that the reaction to the vaccine is not in proportion to the quantity introduced. The injection of 5 c.c. of vaccine into Cow No. 39 gave rise to almost as great an agglutination reaction as the inoculation of 20 c.c. into Cow No. 40, and the reaction persisted as long.

Cow No. 67 received 20 c.c. of "de-vitalised" vaccine subcutaneously. At the time of inoculation her serum caused no agglutination. Six days after the agglutination index registered 1/150, rising to 1/300 on the 14th day, and was at that level on the 63rd day, after which it fell until the 90th day, when it registered 1/200. On that day the cow was inoculated with virus from the fœtus of No. 62, 55 days after which she gave birth to an apparently normal calf. On that day her index was 1/400, while that of the calf was 1/200. Forty-five days after the serum of the cow agglutinated 1/250, and that of the calf 1/200. It is interesting to note the persistence of the agglutinins in the cow and calf after inoculation with virulent material.

4. Injection of Stomach Contents of Aborted Fœtus.

Reference has been made to the inoculation of the vaccinated *Cows Nos.* 39 *and* 67 and the untreated *Cows Nos.* 95 *and* 96 with the stomach contents of the fœtus aborted by *Cow No.* 62, which had previously been inoculated with Sheather's vaccine. Each of these animals received under the skin 50 c.c. of stomach contents mixed with saline, and a further 50 c.c. as a drench. As already stated, *Cow No.* 39 was vaccinated three times before receiving the material from the aborted fœtus. At the time of writing, 100 days after, she has not yet aborted.

The record of *Cow No.* 67 has also been given. This animal gave birth to an apparently healthy calf 55 days after the injection of the fœtal virus.

The inoculation of *Cow No.* 95, which had not been previously treated, with the same virulent material gave rise to an agglutination index of 1/200 on the 15th day. On the 35th day its index was 1/200, when it gave birth to a very weakly calf—possibly premature—the serum of which agglutinated 1/150. Ten days later the agglutination index of both registered 1/150. Seventy days after the index

of the cow stood at 1/250, but the serum of the calf did not agglutinate. It should be noticed that this cow retained her placenta. As far as possible this was removed. It is probable that portions of it were retained, as there was a purulent discharge for some weeks. It is suggested that the persistence and elevation of the agglutination index of this cow for 70 days after the birth of the calf is probably due to the retention of portions of infected membrane—a point of considerable practical importance.

Cow No. 96, not vaccinated, also received 50 c.c. of stomach contents of aborted fœtus of Cow No. 62 *subcutem* and 50 c.c. *per orem*. On the day of treatment its serum caused no agglutination, but 8 days later it agglutinated up to 1/650, and remained thus elevated for 7 days. It then commenced to fall until the 36th day, when it registered 1/250. On the 73rd day the titre stood at 1/350, and on the 93rd day 1/300, after which it rapidly declined, and on the 105th day failed to agglutinate. It is now known that this cow was not in calf at the time of inoculation, and it is interesting to note that the injection of virulent material into this non-pregnant animal rapidly gave rise to the highest agglutination index registered in the experiments. This level, however, persisted for a week only, after which it rapidly declined, and after 105 days disappeared altogether. It is suggested that the stomach contents of the aborted fœtus contained both living and dead organisms, and that, the cow being non-pregnant, the former were unable to establish themselves, while the latter acted as an antigen, giving rise to a marked but brief reaction.

5. The Vaccination of Naturally Infected Animals.

On her arrival *Cow No.* 45 was found to be infected, her agglutination index standing at 1/150. It was therefore decided to inoculate her with 20 c.c. of " de-vitalised " vaccine subcutaneously in order to ascertain whether this exerted any influence upon the titre. For 77 days, however, the index remained at a constant level of 1/150. It then rose gradually until the 127th day, when it stood at 1/300. It fell to 1/100 on the 154th day, and returned to 1/300 on the 190th day, when it was destroyed for another experiment. On post-mortem a careful examination was made of her reproductive organs. No abnormality could be found in the ovaries or uterus, which was empty. From these observations it would appear that when agglutinins have been produced as the result of natural infection the index is not appreciably altered by the introduction of " de-vitalised " vaccine.

But that the vaccine does exert some influence upon chronically infected animals is shown in the case of *Cow No.* 51. This was an animal selected from a herd where the infection had existed for several

years, resulting in a number of non-breeders. She was a typical case, and was known to have had no calf for three or four years, although frequently turning to bull. Her external genital organs were typically contracted. Her serum agglutinated 1/300, and remained at about this level in spite of the inoculation with 20 c.c. of " de-vitalised " vaccine. The clinical results, however, of the inoculation were very marked. Fourteen days after the inoculation the vaginal passage, which hitherto would not admit two fingers, would accommodate the whole of the hand and arm. The vulva relaxed and became almost normal in appearance. Shortly after vaccination the vagina appeared very congested, but this had disappeared after 21 days. The cow was subsequently destroyed, and on post-mortem it was found that the os uteri was so fibrous that it could only with difficulty be cut with a knife. The uterus contained a yellowish glairy material but no fœtus. On the surface of the ovaries were numerous large cysts. This case is of interest by reason of the fact that although, again, vaccination did not affect the pre-existing agglutination index, it produced very profound clinical effects. This is in accordance with practical experience in the field.

Discussion.

Although it is not claimed that the primary object of the foregoing experiments—namely, to prove whether the so-called " de-vitalised " vaccine protects cattle against infectious abortion—has been achieved, the observations may have afforded some information in connection with the agglutination response resulting from the introduction of virulent and non-virulent material into animals under various conditions. It is true the cases have not been sufficiently numerous to base any definite conclusions upon them, but the results appear to be of sufficient interest to justify publication in the hope that they may lead to further investigations.

It has been suggested by several authorities that the most satisfactory method of dealing with this insidious and dangerous disease at the present time is by the detection and elimination of infected animals, which can best be accomplished by the application of the agglutination test. The proper interpretation of the results of the test is therefore a matter of practical importance.

McFadyean has recently drawn attention to the " insidious manner in which the disease may spread in a herd when diseased and healthy animals have to be kept on the same premises," and to " the slowness of the recovery in many of the cows," which " constitutes by far the greatest obstacle in the eradication of the disease." In the herd under his observation it was sought to control the disease by the

removal of infected animals, and yet the disease persisted over a period of ten years. It is obvious, therefore, that the " wearing out " process is not one which can be conscientiously recommended, and that every effort should be made to discover a more scientific method of dealing with the disease. Such a method may be found in vaccination. Several methods of vaccinating have been attempted, but until recently that recommended by Stockman, in which massive doses of live virulent cultures were inoculated into non-pregnant animals, was the most favoured. It had, however, the disadvantage that if by accident it was introduced into a pregnant animal it might cause abortion and so establish a focus of infection. There was also a risk, perhaps a remote one, that the organism when introduced into non-pregnant animals might become established in the udder and remain there until such time as the animal became pregnant, when it might make its way to the fœtal membranes and finally give rise to abortion. Excellent results were attributed to this method, but at the National Veterinary Association, 1921, certain practitioners admitted that they had inoculated pregnant animals with the so-called live vaccine without causing abortion. Edwards, in explanation, stated :—

" The vaccine which was at present issued by the Ministry in England and by the Department in Ireland was undoubtedly obtained from an organism isolated many years ago, and had been kept running in laboratories for many years. Quite early in the study of the disease it had been found that the bacillus could be made to vary its virulence quite readily. Moller in America had found that with the bacilli directly isolated from the cotyledons he could produce abortion in rabbits every time, but when the organism had been cultivated on the surface of media in laboratories for a few generations then they failed to cause abortion. So that probably the reason why one could vaccinate pregnant animals, in direct contravention of the recommendations of the Ministry, was that the organisms which the Ministry employed for making the vaccine had been attenuated."

It would therefore appear that the " live vaccine " has for some time been made up of living organisms which have lost their pathogenic property, and in a letter read before the Fifth Pan-African Veterinary Conference Stockman stated : " I have been working for some time on a quicker method of attenuation." Whether a vaccine composed of such organisms will give rise to any great immunity is open to doubt.

An organism which by continued subcultivation has lost its pathogenicity is likely to have lost also in the process other properties necessary for the production of immune bodies specific against natural

infection. For example, it may have lost its toxins and cannot therefore give rise to anti-toxins. Moreover, the introduction of a living non-virulent organism into an animal does not cause any great disturbance or give rise to that resistance which is necessary for the production of anti-bodies. A dead organism, acting as a foreign body, is better calculated to do so. For example, one frequently drinks water containing *B. coli*, but agglutinins do not result. If, however, *B. coli* were heated and injected under the skin, agglutinins would probably be formed.

Anti-abortion vaccines composed of dead organisms, however, have been generally condemned; nor is this surprising, since such vaccines have generally been composed of organisms and their toxins destroyed by excessive heat. Such could not be expected to give rise to specific anti-bodies of protective value. In the so-called "de-vitalised" vaccine it was sought to overcome this objection by submitting massive cultures of virulent and agglutinating organisms to the action of chloroform, an agent selected on account of the fact that, according to the researches of Duval and Harris in connection with Pfeiffer's bacillus, it "de-vitalises the bacilli by rapidly absorbing the water, and in consequence increasing the permeability, which results first in plasmolysis, then rupture of the bacterial cell, liberating without affecting in any manner its toxic moiety." That the *B. abortus* contains endo-toxins was shown by Stockman and McFadyean, and it was desired to retain these together with the other elements of the organism in order to give rise to anti-bodies specific against the *B. abortus* of natural infection.

The "de-vitalised" vaccine was also intended to overcome the disadvantages of the "live" vaccines made up of virulent organisms which could not be administered to pregnant animals, and of the "live" vaccines made up of non-virulent organisms which by numerous subcultivations had lost their pathogenic and probably other properties important in the production of a specific immunity.

From the observations made in the course of the foregoing experiments it would appear that the production of agglutinins is proportionate to the disturbance set up by and the resistance to the foreign material introduced into the animal body. It may be well to analyse the cases from this point of view.

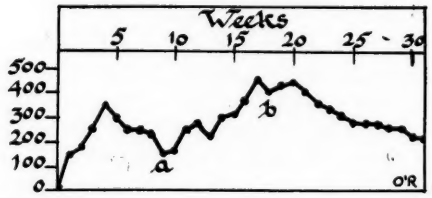
The lowest agglutination response was met with in *Cow No.* 38, which received 20 c.c. of a suspension of the laboratory strain of *B. abortus*. This strain was until recently known to be virulent, but the reaction suggests that it may have ceased to be so. For five weeks after the inoculation no agglutinins were formed, after which they appeared but never reached a high index. They were highest at the

time of the birth of the calf, when they reached about 1/250. Six weeks after they still persisted, probably as the result of retention of part of the placenta. It is probable that the organism, being alive but of low virulence, slowly established itself without doing much harm to the fœtal membranes. There was, therefore, little necessity for resistance and consequently few agglutinins were formed.

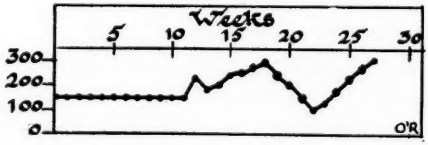
When live cultures were inoculated into *Cow No.* 62, which was pregnant, agglutinins soon appeared in the serum and remained there, although the agglutination index never reached a very high level. When the fœtus was aborted twelve weeks after inoculation the agglutination index was only 1/100, after which it rose to 1/150. In this case it is probable that the living bacteria made their way to the fœtal membranes and, becoming established there, exerted their pathogenic influences without giving rise to any great resistance. As in other cases, the retention of the fœtal membranes was probably responsible for the persistence of the agglutinins after the expulsion of the calf.

In *Cow No.* 37, however, which received a similar injection of live virulent organisms, agglutinins also appeared early, but the titre soon reached a comparatively high level. Agglutinins persisted for 35 weeks. This cow was never noticed to abort, but clinical observations indicate that she did so about 60 days after the injection. It was not until the 34th week after the inoculation that she showed signs of œstrum. The persistence of agglutinins for so many weeks is probably due to the infected condition of the uterus, which was revealed on post-mortem examination.

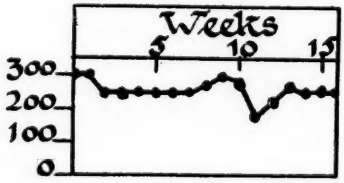
These reactions may be compared with those of *Cows Nos.* 39, 40, *and* 67 inoculated with " de-vitalised " vaccine. In these agglutinins appeared rapidly and soon reached a comparatively high level, which was maintained by re-inoculation. It is suggested that the introduction of organisms which cannot grow, as with any other foreign body, gives rise to an immediate resistance resulting in the formation of anti-bodies specifically related to the material introduced. In the case of " de-vitalised " vaccine it is hoped that the anti-bodies consist not only of bacteriolytic and agglutinating substances, but also of anti-toxins. But as immunity must of necessity be of a passive character, it no doubt dies out after a comparatively short period. In order that it may be maintained as long as possible, re-inoculations have been recommended at intervals of two months. To be of any practical use the immunity should be prolonged for at least nine months in order to cover the normal period of gestation. The " de-vitalised " vaccine produces no harmful effects upon pregnant or non-pregnant animals, and therefore the inoculations can be



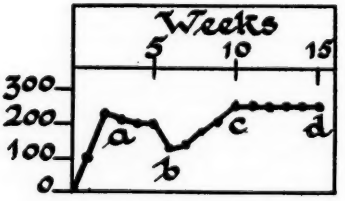
Cow No. 40 Received 22 c.c. " De-vitalised " Vaccine Subcutaneously.
(*a*) Re-inoculated 20 c.c. (*b*) Re-inoculated 20 c.c.



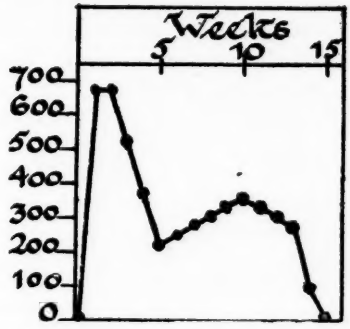
Cow No. 45 (Naturally Infected) Received 20 c.c. "De-vitalised" Vaccine Subcutaneously.



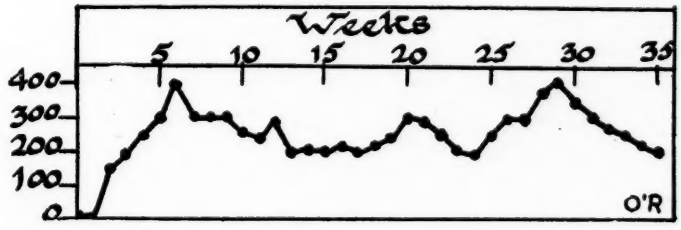
Cow No. 51 (Chronic Infection) Received 100 c.c. "De-vitalised" Vaccine Subcutaneously.



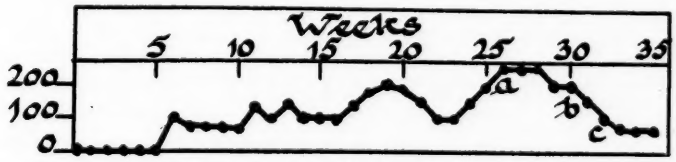
Cow No. 95 Received 50 c.c. Stomach Contents of Aborted Fœtus of Cow No. 62 *Subcutem* and 50 c.c. *Per Orem*.
(*a*) Calved. Weakly calf. Calf's Titre 1/150. (*b*) Retained Placenta. (*c*) Calf's Titre 1/200. (*d*) Calf's Titre negative.



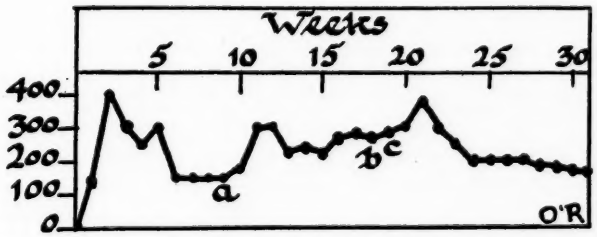
Cow No. 96 Received 50 c.c. Stomach Contents of Aborted Fœtus of Cow No. 62 *Subcutem* and 50 c.c. *Per Orem.*



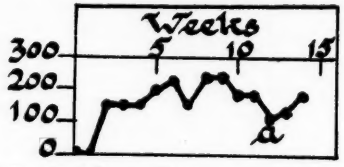
Cow No. 37 Received 20 c c. Sheather's No. 66 Culture in Saline Intravenously.



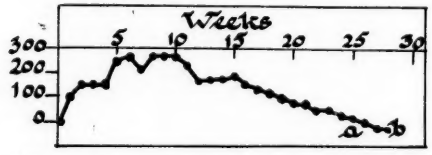
Cow No. 38 Received 20 c.c. Laboratory Strain in Saline Intravenously.
(*a*) Calved. Calf's Titre 1/400. (*b*) Calf's Titre 1/250. (*c*) Calf's Titre 1/150.



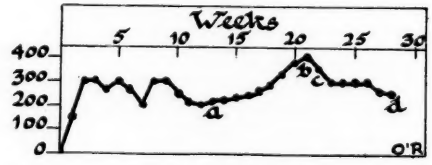
Cow No. 39 Received 5 c.c. "De-vitalised" Vaccine Subcutaneously.
(*a*) Re-inoculated 5 c.c. (*b*) Re-inoculated 5 c.c. (*c*) Received Virus from Fœtus of No. 62.



Cow No 62 Received 20 c.c. Sheather's No. 66 Intravenously.
(*a*) Aborted Fœtus 6 months.



Cow No. 66 Received 5 c.c. "De-vitalised" Vaccine Subcutaneously.
(*a*) Calved apparently Normal Calf. (*b*) Calf's Titre 1/50.



Cow No. 67 Received 20 c.c. "De-vitalised" Vaccine Subcutaneously.
(*a*) Received Virus from Fœtus of No. 62. (*b*) Calf's Titre 1/200. (*c*) Calved apparently Normal Calf. (*d*) Calf's Titre 1/200.

repeated during pregnancy, which would be impossible in the case of vaccines made up of virulent material.

The persistence of agglutinins in cows which have retained portions of the fœtal membranes is an observation of some interest. It is possible that such infected material may act as a vaccine and may be a factor in the establishment of herd immunity. If such a thing as herd immunity is ever established, it can only be as the result of the infection and recovery of all females of the herd, for infection is maintained indefinitely in carriers and non-immune animals are in constant danger of becoming infected.

It was at one time believed that infected animals rarely abort more than two or three times. This is probably incorrect. It is probable that an infected cow may abort several times, but the calf may be so small as to escape detection. In a milk herd under close observation where irrigation was practised, the owner reported that he frequently washed away "a little calf no bigger than his thumb-nail." The retention of infective material in such cases might act as a vaccine and eventually give rise to immunity. Such a process of natural vaccination would involve the creation of a large number of sterile animals, and if it were possible is not to be recommended.

The inoculation of a non-pregnant animal with large quantities of the contents of the stomach of an aborted fœtus gave rise to the highest agglutination reaction recorded in the experiments. This rapidly declined, and in about 15 weeks no agglutinins remained. It is probable that the reaction was chiefly due to the introduction of dead rather than living organisms.

Although it has been shown by other observers that the serum of calves from infected mothers will agglutinate, it is interesting to note that those from cows which have been inoculated with avirulent cultures or vaccines also possess agglutinins which persist for long periods. In the case of the calf of *Cow No.* 66 the agglutinins remained in the calf after they had disappeared from its mother.

The observation that the introduction of vaccine into naturally infected animals already possessing agglutinins in their blood does not enhance the titre is of interest, since re-inoculation of vaccinated animals generally does so. The clinical results following the inoculation of *Cow No.* 51 confirm the observations of many laymen and those recorded in Departmental Bulletin No. 488.

Conclusions.

Agglutinins appear to be associated with resistance to, and destruction of, foreign elements introduced naturally or artificially into the body, and to be produced in proportion to the disturbance set up by, and the resistance to, the material so introduced. They are specifically related to the antigens which gave rise to them, and in the case of bacteria are believed to prepare them for phagocytosis and final elimination.

On this assumption it was sought to produce by vaccines, agglutinins specific to the *B. abortus* of Bang, with a view to protecting cattle against infectious abortion.

It is held that such a vaccine to be effective must be one which, while non-pathogenic, will give rise to the necessary stimulus to create the greatest number of agglutinins specifically related to the essential properties of the organism causing natural infection.

It is recognised that such essential properties are lost by frequent subcultivation, heat, and chemical processes.

The reaction set up should be one which can be maintained with safety during the whole period of gestation.

It is suggested that living but non-virulent organisms are not likely to cause the stimulus necessary for marked agglutination response, and that, having lost their pathogenic properties, they cannot give rise to the specific agglutinins necessary to protect against natural infection.

On the other hand, living virulent organisms may establish them-

selves in the animal and give rise to agglutinins as the result of the damage effected by them. Vaccines composed of such organisms, however, may cause abortion or create a focus of infection.

The retention of fœtal membranes appears to result in the production of agglutinins, and may be a factor in the establishment of herd immunity.

The blood of calves born of reacting mothers contains agglutinins at the time of birth and for some time after.

In view of recent observations by McFadyean, which show the persistence of the disease and that herd immunity is not readily established, every effort should be made to perfect a means whereby immunity may be artificially created.

ACKNOWLEDGEMENT.

I desire to express my appreciation of the assistance given me by Captain P. D. Huston, M.R.C.V.S., and Mr. A. J. Crisp, in connection with the observations upon which this report is based.

LINGUATULA SERRATA, FRÖLICH 1789, IN THE NASAL CAVITY OF A BULL BITCH.

BY A. W. NOËL PILLERS, F.R.C.V.S.,
Liverpool.

RECORDS of the above interesting parasite are so uncommon that the finding of it tempts one to report the case, and to discuss some of the parasitological aspects of the species. H. Tudor Hughes (1) gave an account, in 1913, of the presence of one female in the nasal cavity of an otter hound in Shropshire affected with disease of the middle ear. Later on he was kind enough to present the specimen to me. J. F. D. Tutt (2) recorded in the same year the finding of the parasite in a bulldog and a Yorkshire toy terrier. Professor Dick (3), in 1840, wrote of a case which has since often been quoted. An apparently healthy dog died suddenly, and the only abnormality found at the autopsy was three linguatules, one in the larynx, one in the trachea, and a third in a bronchus.

The adult female, which is most likely to be encountered, is lanceolate in shape, dorso-ventrally flattened, composed of about ninety segments, whitish in colour, the anterior extremity rounded, and the posterior tapering. It is 8 to 10 cm. long, 1 cm. wide at the broadest part near the head, and 2 mm. wide near the posterior extremity. The male is very much smaller. In the present instance I am indebted to Mr. G. L. Locke, M.R.C.V.S., of Manchester, for forwarding an

adult female, and for permission to conduct the post-mortem examination, which led to the discovery of a second specimen.

On September 24, 1924, a seven-year-old bull bitch was noticed to have "something" hanging from one of her nostrils. The owner removed it. There were no previous symptoms. No treatment had been or was adopted. The parasite measured 8·5 cm. in length by 1 cm. at its widest part (Fig. 1). On December 8th the bitch was destroyed for other reasons, and I made an examination of the carcass on December 11th. Careful search of all the organs of the thoracic and abdominal cavities failed to disclose any immature forms. On splitting the head and removing the septum nasi, another female, 3·5 cm. long by 1 cm. wide, was found unattached and lying between the ethmoturbinals and the lower (head vertical) bony limit of the frontal sinus of the right side. There appeared to be no evidence of the point of attachment of this specimen. There was a small amount of mucus in the right nostril, but it contained no eggs, neither were there any in the fæces.

Parasites of this kind have usually been spoken of as pentastomes, porocephalids, and linguatulids. The adult found in the nasal cavities rejoices in a large number of names, some of the most important of which are: *Tænia lanceolata*, Rudolphi 1805; *Tænia rhinaris*, Pilger 1803; *Polystoma tænioides*, Rudolphi 1809; *Linguatula tænioides*, Lamark 1816; *Pentastomum tænioides*, Rudolphi 1819; *Linguatula lanceolata*, de Blainville 1828.

The immature form has likewise an extensive synonymy: *Tænia caprina*, Gmelin 1800; *Polystoma serratus*, Goeze 1803; *Linguatula denticulata*, Rudolphi 1805; *Polystoma denticulatum*, Rudolphi 1809; *Echinorhynchus capræ*, Braun 1809; *Tetragulus caviæ*, Bosc 1810; *Pentastomum denticulatum*, Rudolphi 1819.

The name appearing in the title was first given to the immature form, long before the adult was described as another species, and years before they were shown to be nymph and adult of one parasite. The adult linguatulid is recorded as having been found in the nasal cavities of a large number of animals, including the following, which are natives of this country: the dog, fox, horse, mule, goat, and man (very rarely). Although it appears to be rare here, G. Colin found it sixty-four times during a two years' study of 630 dogs at Alfort. That is to say, about 10 per cent. of the animals were affected; there were from one to eleven parasites per dog, with a total of 146. At Toulouse Neumann (4) found five dogs out of 60 harbouring from one to four specimens each. In Berlin Deffke found it thirteen times in 200 dogs. I have examined a considerable number of heads without previously having encountered it.

The immature forms are stated to occur in the viscera, chiefly the mesenteric lymphatic glands, liver, and lungs of herbivora or animals, upon which the harbourer of the adult may prey, such as the sheep, goat, ox, pig, horse, rabbit, hare, guinea-pig, rat, cat, and man. In the latter it is not rare in Germany, and Cobbold (5) states that he found it several times here. Neumann found it in five cats out of 150 examined—once in the pleura, once in the peritoneum, and in the others under the pulmonary pleura in miliary abscesses.

Neumann's account, from which some of the above figures have been taken, is a good one from the veterinarian's point of view, and Southwell's (6) is devoted to a systematic consideration.

The exact position of the linguatulids in the animal kingdom is still a matter of dispute amongst systematists, but the majority

FIG. 1.—*Linguatula serrata*. Adult Female. Reduced $\frac{1}{6}$.

regard them as aberrant or degenerate acarids, as is shown by the following downward classification :—

Sub-phylum, Arthropoda. Class, Arachnida. Natural Order, Acarina. Family, Linguatulidæ. Sub-family, Porocephalinæ. Section Linguatulini. Genus, *Linguatula*.

It will be seen, therefore, that they are related to the ticks and mites. Many authorities use different terms to describe the same stages in the life-cycle between the egg and the adult. Thus Cobbold mentions a " pupa," which is followed by a " larva," and Neumann writes of an encysted nymph turning into a larva. Both of these, it would appear, are not in accordance with modern terminology as applied to the Acarina. We are indebted to Leuckart, G. Colin, M. Koch, and others for our knowledge of the life-cycle of this species.

After fertilisation the female lays about 500,000 brownish, ovoid eggs, 90 μ long and 70 μ wide. These pass out through the anterior nares, or in the fæces, to the exterior, where the contained *acariform embryos* are capable of living for several weeks. On being taken in by a suitable host, such as a herbivorous animal, the eggshell is dissolved in the stomach, and the embryo is liberated. It then measures about 130 μ by 50 μ, and has two pairs of legs and an anterior perforating apparatus. By entering the lymph or bloodvessels of the intestinal

wall the parasite may be carried to the mesenteric lymphatic glands, thoracic duct and lungs, or by the veins to the portal vein and liver. Here the legs and other external structures are lost, and the *larva* becomes encysted. It then measures about 300 μ by 150 μ. After a series of moults, approximately six months from infestation, the *nymph* is from 5 to 8 mm. in length, possess cephalic hooklets, and has eighty to ninety annulations, from which project in a backward direction numerous minute spines (Fig. 2). By means of their hooklets and spines these larvæ leave their original situations; many perish in the pleura and peritoneal cavities; whilst others gain the bronchi or intestine, to be expelled to the exterior, where their resistance is considerable. Some may be arrested in the nasal cavity, and so complete the life-cycle in one host. It is stated that such is the explanation of the exceptional finding of adults in the upper air-passages of herbivora. A case is recorded by Landon (7) of a man who in 1870 suffered from icterus and intestinal disorders. After a couple of years

FIG. 2.—*Linguatula serrata.* Nymph. × approx. 20.

the symptoms abated, but bleeding from the nose occurred for seven years. There was pain in the left nasal cavity. In 1878 these symptoms were aggravated, and after an attack of sneezing a linguatulid was expelled. The bleeding from the nose ceased, and the patient soon recovered. It is believed that the first illness was connected with the invasion of the liver by linguatulids, that after encystment the symptoms abated, and that one or a few adults ultimately settled in the nose and caused the intermittent epistaxis. It is stated that if nymph-containing viscera is eaten by a dog, the parasites may enter the nasal cavity by the nostrils (G. Colin), or by the posterior nares (Leuckart), by climbing up the œsophagus. On the other hand, Gerlach states that the nymph may arrive in the trachea by direct passage through the stomach wall to the lungs. Having arrived in the nasal cavities, the cuticle of spines is lost, the parasite grows, and pairing takes place. The duration of the life-cycle is stated to vary around fifteen months. It has been shown that if viscera infested with larval linguatulids be fed to dogs, the parasites may be found some days after in the peritoneal cavity (Gerlach). The presence of immature forms in naturally occurring cases in the cat and other

carnivora may arise in this way. Cobbold leads one to believe that human beings may take the eggs in from the dog and so develop visceral lesions. Diagnosis is based upon finding the eggs surrounded by a gelatinous covering, in cases showing signs of nasal irritation.

Mesenteric lymphatic glands, such as those of the sheep, which contain immature linguatulids, show on section small brown areas, and later become pitted in places. After a while these small cavities unite into larger ones, which contain a brownish liquid, in which the parasites may be found. Sometimes small punctures are seen on the outer surface of the glands. Later green spots and fibrous areas appear, indicating either the death or departure of the nymphs.

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THE ANATOMY OF THE PARATHYROIDS OF THE DOG.

By B. Gorton, M.R.C.V.S., M.P.S.,
Professor of Anatomy in the Royal Veterinary College, London.

It may not be without interest to record the result of the anatomical examination of twenty dogs of various breeds with regard to the position and other naked-eye characters of the parathyroid bodies or glands. It must be stated at once that some of the bodies described in the following notes were examined microscopically, and all so examined proved to be true parathyroid tissue. Sufficient were examined in this way to permit of the presumption that all similar bodies were parathyroid also. In those cases where no visible or definite bodies were discoverable no microscopical examination was made, as the purpose of the notes is only to record the presence and position of the glands obvious to the naked eye on careful examination. It must not be supposed that, where no distinct bodies were visible, there was an absence of true parathyroid tissue, for in these cases no doubt it would be easy to prove the presence of this tissue by examining sections of the thyroid.

Before details of the parathyroids are given, perhaps it would be of value to indicate some of the variations exhibited by the thyroid gland. The isthmus is generally absent in small dogs, and not common in large dogs. If present, it is a narrow band of glandular tissue crossing the trachea ventrally, connecting the posterior poles of the thyroid lobes. The most marked isthmus in this series of dogs occurred in a chow. The size of the lobes of the thyroid vary considerably in apparently healthy dogs. For instance, of two terriers of equal size, one had lobes 23 millimetres long by 8 wide, whilst in the other the lobes were 25 × 10 millimetres, and much thicker in proportion, so that the total bulk was about double. The size of the lobes, no doubt, is partly due to the amount of contained blood. Another noticeable variation was in the colour. In some cases the thyroid was pale red, hardly distinguishable from muscular tissue. In others it was dark red, approaching black. Between these extremes there were all shades of red, with varying tints of blue. All these variations were due to the blood contained in the gland.

Passing on to the parathyroids themselves, it will not be out of place to quote the description of these bodies in the dog from Sisson's *Anatomy of the Domestic Animals*. It is stated that the parathyroids are usually four in number, and about the size of a millet or hempseed. Two are situated on the deep face of the thyroid, in which they are often embedded, the others are placed laterally near the anterior extremity. The examination of the twenty dogs gave the following details :—

I. *Great Dane*.—In this case each lobe of the thyroid showed on the superficial surface near the anterior extremity a partly detached parathyroid of the same colour as the thyroid. One parathyroid was 8 millimetres long, the other was shorter. There were no bodies embedded in the deep surface.

II and III. *Two Greyhounds*.—In these dogs the parathyroids were pale in colour and rounded in outline, about 4 millimetres in diameter, partly embedded in the superficial aspect of the anterior extremity of the thyroid lobes. There were none visible on the deep surface.

IV. *Fox Terrier*.—Each lobe of the thyroid showed a small rounded parathyroid anteriorly, but none on the deep surface. The thyroid was very large.

V. *Collie*.—There was present in this dog a parathyroid at the anterior pole of each lobe, pale in colour. The left lobe showed an embedded gland on the ventral border, about the middle.

VI. *Collie*.—Each lobe possessed two parathyroids, a large one rounded in outline, pale in colour, and 7 millimetres in diameter,

upon the superficial face just in front of the middle of the lobe, and another, smaller, embedded in the dorsal border towards the posterior pole.

VII. *Fox Terrier.*—Each lobe had an elongated parathyroid superficially at the front, and a smaller one on the deep surface.

VIII. *Lurcher.*—In this dog the superficial glands were 7 millimetres long, and on the lateral face of the lobes. On the deep face there were small ones embedded.

IX. *Fox Terrier.*—Two parathyroids present, each a rounded body near the posterior poles.

X. *Mastiff.*—On the left side there were two parathyroids, one superficial and one deep. The right was destitute of visible glands.

XI. *Wolfhound.*—One lobe showed a small rounded parathyroid anteriorly. The other had two, one anterior and one embedded in the ventral edge.

XII. *Great Dane.*—A large parathyroid at each anterior pole, and an embedded smaller one on each deep surface.

XIII. *Greyhound.*—No parathyroids were discoverable in this animal, which suffered from chorea. It had been treated with parathyroid substance by its owner, who thought the chorea was of parathyroid origin.

XIV. *Airedale.*—Parathyroids absent.

XV. *Mongrel Terrier.*—Each lobe showed two parathyroids on the superficial surface, one at the centre and one near the anterior pole.

XVI. *Airedale.*—The left lobe showed nothing. The right lobe had a small embedded parathyroid anteriorly.

XVII. *Chow.*—Left lobe had a small gland near the posterior extremity. Right lobe was destitute of the glands.

XVIII. *Fox Terrier.*—The left lobe showed a superficial parathyroid at the anterior pole, none on the deep surface. Right lobe had a parathyroid on the ventral border.

XIX. *Fox Terrier.*—The parathyroids were four in number, one at each anterior extremity, one on each deep surface.

XX. *Alsatian.*—Each lobe showed an elongated parathyroid at the anterior extremity. There were none deeply placed.

Summary.—From the above particulars it is seen that in eleven out of the twenty cases the parathyroids were present at the anterior extremity of the thyroid body on both sides. Three of these had embedded glands on the deep surface. Thus 15 per cent. of the cases corresponded to the description in Sisson. In one case there were parathyroids at the posterior poles. In two cases they were absent altogether, and in three cases absent on one side. Altogether the examination of these dogs indicates that parathyroids on the super-

ficial surface of the thyroid are generally present. Well-marked parathyroids on the deep surface are not so common.

Finally, it is conceivable that, at some future time when our knowledge of the functions of the endocrine glands is greater, the position of the parathyroids may be of more importance in the surgery of the dog than it is at present. Case XIII seems to indicate that it would be worth while to direct attention to these glands in cases of chorea.

Clinical Articles

BURSITIS OF THE BURSA OF THE CORACO-RADIALIS OR BICEPS MUSCLE.

By R. Hudson, F.R.C.V.S.,
Retford.

The subject was a four-year-old shire filly, and it was thought that she had bumped her shoulder on entering the stable, the turning into which was awkward.

She had been lame several weeks, and a swelling as large as a cocoanut was present over the region of the biceps muscle and the point of the shoulder. It was hard, painful to the touch, and on much pressure I thought it fluctuated slightly. The mare walked lame and extension of the limb was not complete. Rest, hot fomentations, rubbing with plumbi-zinc lotion during two to three weeks, brought about some improvement both in the size of the swelling and in the lameness, but the swelling still remained very hard.

Feeling sure that fluid was present, I punctured with a small trochar to a depth of about 2 inches, but failed to withdraw anything.

A week later I again punctured, but this time with a scalpel, and found at a depth of about 2½ inches a quantity of clear lymph and lymph clots.

Enlarging the opening to the extent of about 2 inches, I cleared out all the lymph clots I could reach, from a cavity extending under the biceps to the bicipital grooves. The cavity was syringed out with Ac. Carb. 1 in 40, and instructions left to syringe out twice daily and keep the outer wound clean.

After about a week the mare was led out daily; and although at the beginning she walked better, it was soon found that she went much worse, so the exercise was discontinued.

Visiting a week later, I found the enlargement and discharge subsiding, but the lameness was greater and the motion of the leg

peculiar. It was advanced with difficulty. The sound off fore-leg was brought centrally under the chest, and as weight came on it the lame leg was carried round and placed in front. Great pain was shown when the leg was advanced and movement was controlled with difficulty.

Complete rest, hot fomentations, and syringing out with carbolic lotion was advised.

At my next visit a week later I was informed that a slough had worked out of the wound; the wound was healing nicely. The mare was moving better and did not plait her legs as before. Injection was carried out as long as it was possible to get any into the wound.

A week later the mare was walking so well I had her turned out in a paddock for a few hours daily; the wound is healed, and the swelling has almost disappeared.

She eventually became quite sound and was put to work.

Remarks.—Diagnosis. That the swelling was due to distension of the biceps bursa was difficult to verify when no fluid came away, which may have been due to the cannula being blocked by lymph clot, or it may not have penetrated deep enough.

The question whether it was best to open the bursa is settled by the result. If it had not been done, the swelling would have remained; owing to the presence of lymph clots the mare would have worked lame. A large opening enabled the clots to be removed and retarded the closing of the wound until the cavity had closed and healed. It is difficult to imagine that infection of the bursa did not take place, though the secretion was never like pus. Gentle exercise was advised —although too soon—to prevent adhesion of the tendons in the grooves.

LATHYRUS POISONING IN THE HORSE.

By J. AUGUSTUS VOELCKER, D.Sc.,
Consulting Chemist to the Royal Agricultural Society of England.

A prominent breeder of cart-horses in Norfolk purchased in June 1923 12 tons of a compound food, consisting of a preparation of maize with peas.

He began feeding it to nineteen horses on August 13, 1923, the only other food given being bran and chaff. The first symptoms of anything amiss were observed on September 2nd, when the first horse was shot, as it was so ill. No post-mortem was made. On September 5th and 6th two other horses began to tumble about and to show signs of paralysis, but they seemed to get over it, and the feeding with the maize mixture was continued until December 13th, when it was

stopped. On December 31st a second horse had to be shot, a third on January 12, 1924, and a fourth on January 24th. Post-mortems were made on these three, the last in London.

Though the feeding with the mixture was given up after December 13th, the horses that had previously had it continued to be very indisposed. A fifth horse was taken ill on January 1, 1924, and was still indisposed on February 22nd, when the sample of "mixture" was submitted to me. A sixth horse was taken ill early in February and tumbled about, dying on February 17th. A sample of the food was submitted to me on February 22, 1924, and also a separate sample of the peas that had been used in the mixture. These were called "Mutta peas," and I recognised them—as also peas present in the mixture—as being those of *Lathyrus sativus*, but whether of the poisonous or of the non-poisonous variety I could not say.

I subsequently heard that up to July 20, 1924, eleven horses in all had died or been shot, and that the remainder still showed signs of poisoning, though they had had none of the food since December 13, 1923.

Professor Macqueen had seen the horses and expressed a very strong opinion that they were poisoned by the "Mutta peas" in the mixture.

The vendors behaved very handsomely and gave compensation for all losses, undertaking further responsibility for any that might occur up to January 1925.

UNDIAGNOSED.

By J. G. HOBAN, M.R.C.V.S.,
Whitchurch.

Subject.—A seven-year-old hurdler, winner of a few races.

History.—Whilst at exercise one morning suddenly "broke out," and after returning to stable and being rubbed down continued to sweat profusely. Did this continually for two days, and took little or no food or water. Showed no signs of pain. No history of a previous illness.

On the third day (Monday) I saw the animal. Found him restless, pulse accelerated, temperature normal, mucous membranes slightly dirty, breathing somewhat rapid, but very profuse sweating. Only a small bran mash and some carrots had been eaten since the onset, and no water taken. The fæces were small in amount and "oily," and the urine, though scanty, was normal when tested. When led out the animal moved stiffly, but showed no definite symptoms of

pain—just periodic restlessness, followed by absolute listlessness for an hour or so. He seemed happier when someone stood in the box.

Course.—This continued without variation for three days longer, the only food eaten being a handful of grass and a few carrots. On the fourth day the sweating abated somewhat, and the patient seemed easier and showed an inclination for food. Next day there was no sweating, but that night it returned worse than ever, though food was freely eaten.

The sweating stopped, though the appetite varied daily, and a very great loss of flesh occurred—in fact, at the end of three weeks he was " skin and bone," and stayed so for over a fortnight, though eating better daily.

Appetite, flesh, and vigour gradually came back, and the animal resumed normal work and showed no permanent weakness.

Treatment.—Large doses of potassium nitrate were given twice daily, with the object of relieving the sweating, and quinine sulphate in bolus, followed by cod-liver oil in the later stages, and finally a course of arsenic and iron.

The interesting points were: The absolute sudden onset and no definite signs of organic trouble, even though the animal was examined at various hours of the day and night, and the alarming sweating—it actually dripped continually from all over his body.

THE RADICAL OPERATION FOR TRAUMATIC PERICARDITIS IN CATTLE (PERICARDIOTOMY).

By L. P. PUGH, F.R.C.V.S.,
Sevenoaks.

Introduction.

Once the diagnosis of traumatic pericarditis has been made, it is the usual precedure to recommend immediate slaughter in the hope of salving the carcass. If left to " nature " death is sure to supervene.

It is an unfortunate fact that traumatic infection of the pericardium is most prone to occur as a result of the excessive straining in connection with the act of parturition, and therefore at a time when a cow should be becoming most profitable. There is also the point that a cow may be worth several hundred pounds as a breeding or show animal, but may only be worth a few pounds when slaughtered.

Moussu recommended the removal of fluid from the pericardial sac by puncture with a trocar and cannula, starting from the direction of the ziphoid cartilage. This procedure is intended to allow salvage of the carcass for human consumption, and it does not aim at the

complete restoration of the beast to utility. It was decided, therefore, to attempt a radical operation by opening up the pericardium freely in order to allow good drainage and to remove the offending foreign body (if still present). It is necessary to put in this latter qualification, since a piece of wire can puncture the wall of the stomach, the diaphragm, and the pericardium, admitting infection into the latter, and yet be withdrawn by movements of the gastric contents. It is a recognised point that foreign bodies are often impossible to find, although the damage is only too apparent.

Technique of Operation.

Morphia is administered subcutaneously half an hour before operation. The lower half of the left chest wall is shaved and painted with tincture of iodine.

The cow is put down by Rouff's method on to her right side, and an assistant placed at her head to restrain movements. The upper fore leg is drawn forward and tied by rope to a peg fixed in the ground. The hind legs are tied back in a similar manner.

The heart should be auscultated, as its position will depend on the amount of fluid and gas in the pericardium. Having settled this point it is necessary to choose the rib overlying the heart, choosing the more anterior one if two are in question. A line is drawn along the course of the rib starting from the costo-chondral joint and extending upwards for about 8 inches. The skin and underlying tissues along this line are then injected with cocaine. As soon as the latter has had time to anæsthetise the area, a bold incision is made along the above-mentioned line, using a sharp-pointed scalpel. The incision should be deep, and should go right down on to the rib and down to the level of the joint. A large retractor is inserted on either side and held by an assistant, whilst the muscular attachments are severed from the rib. The upper extreme of the exposed portion of rib is then sawn through, using the flat side of a Hey's saw. The sawing should stop immediately the bony tissue is severed. A sharp hook is inserted into the upper end of the lower segment of rib and slight traction is exerted, whilst the intercostal muscles are severed near to the bone. By inserting the blade of a small scalpel into the costo-chondral joint the lower segment of rib is soon detached and removed.

The wound is cleansed with normal saline to which has been added perchloride of mercury (1 in 1,000), after which the exposed surfaces are dried and B.I.P.P. paste rubbed in. A trocar and cannula is now inserted into the pericardium, and the nature of the contained fluid ascertained. If the latter is copious, it should be allowed to flow

out for a time in order to reduce the pericardial pressure slowly. As soon as it is considered that the pressure is sufficiently lowered a blunt pointed curved bistoury is inserted alongside of the cannula and the pericardial wall incised down to the lower level of the wound. The remaining fluid or pus escapes rapidly. A hand is now inserted into the pericardial cavity, and is moved about carefully in order to detect the foreign body if present. Any loose masses of consolidated pus or fibrin are removed. Without removing the hand a long rubber catheter is inserted and the cavity thoroughly flushed out whilst the hand agitates the fluid. These flushings are made with normal saline solution to which a small amount of perchloride of mercury has been added (1 in 6,000).

The cow is allowed to stand up in order that the fluids in the sac may drain away. It is found that the cardiac movement facilitates this, although there is always a little liquid remaining in the most dependent part of the cavity. The wound is plugged lightly with boracic gauze, and the whole operation site covered up with a clean round towel.

After treatment consists of bi-daily flushings of the pericardial cavity with the same strength solution as used in the operation, and the external wound is treated with B.I.P.P. paste. This treatment can be carried out by any intelligent herdsman. It is, of course, necessary for the veterinary attendant to keep a watch on the case, and if necessary to re-explore the pericardial cavity for necrotic material or retained discharges.

Three cows have been so treated by the writer, and as all rallied from the actual operation, it is proposed to give a few brief details of each case.

Case I will be given in more detail, because this cow was operated on ten months ago, and has made a perfect and complete recovery, as far as can be detected. She is shown in the accompanying illustration, the latter having been taken nine months after the operation.

Case I.—Pedigree Guernsey Cow. Freshly calved and sold subject to her passing the Tuberculin Test.

It was found that a normal pre-inoculation temperature could not be obtained. On the twenty-second day following parturition the cow became very ill. Temperature 104·5° F. Pulse rapid and small. Blood-coated fæces in little amounts. Eyes sunken and a purulent discharge from the inner canthus. Cow standing persistently, and when moved reeled slightly.

Auscultation of the heart revealed a rapid "jumpy" action and rather indistinct. Decided friction sounds could be detected

in connection with the heart beats. The jugular furrow full and a jugular pulse present. There was no œdema under the jaw nor under the brisket. There was complete anorexia. As the cow was obviously soon going to die if left, permission was obtained to attempt an operation.

About half a gallon of turbid fluid was removed through the cannula before incising the pericardium. Even so, there was a somewhat violent rush of fluid on opening the sac. The inner surface of the pericardium was covered by a thick layer of purulent-looking material. The heart was similarly covered. There was a firm adhesion between the myocardium at the lower third of its posterior surface and the pericardium. It was not considered wise to interfere

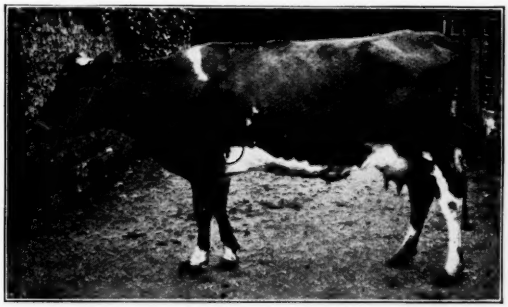


PHOTO OF CASE 1, TAKEN NINE MONTHS AFTER OPERATION.
The black line in circle is the exact place of scar.

with this, although there was the possibility that the foreign body might be embedded in it.

Forty-eight hours after operation the wound appeared in a very septic condition, and a fœtid discharge coming away from the pericardium. A good deal of necrotic material was curetted away from the external wound. Otherwise the treatment was as indicated.

At the end of ten days the wound appeared quite healthy, and the patient feeding, drinking, and coming up in her milk yield.

At the end of a month the cow was turned out with the rest of the herd, and seven weeks after operation the scar had dried.

The cow has milked well since recovering, and at one time was giving over three gallons daily. She is now well on in calf and appears in excellent health. (See photograph.)

Case II.—Young Jersey Cow in poor condition. She was noticed to be ill ten days after parturition. Examination revealed the cause

to be traumatic pericarditis associated with œdema under the jaw and brisket. Temperature 102·5° F. Complete anorexia.

The operation was performed as indicated. The pericardium contained about half a gallon of greyish yellow pus with a very fœtid odour. A piece of wire $2\frac{3}{4}$ inches in length was found and removed from the lower posterior part of the sac. The wire itself was identified by the owner as being the same kind that he had used for putting up a wire surrounding to his tennis court, and he recalled the fact that the cow had been grazing near him whilst at this work.

The cow rallied from the operation and did well for ten days, maintaining a good appetite. At this time, however, she developed pneumonia and died in three days. Post-mortem examination revealed the cause of death to be septic pneumonia of left lung and septic pleurisy. There were extensive tubercular lesions in both lungs, and it is possible that they may have predisposed to this complication.

The inner surface of the pericardium showed a number of irregular ulcerated surfaces covered by soft necrotic material. The heart itself presented no obvious abnormality.

Case III.—Crossbred Friesian Shorthorn Cow. Found acutely ill eight days after delivering her fifth calf. Temperature 106·2° F. Unable to rise. Groaning and apparently at the point of death. Very distinct "splashings" could be heard on auscultating the heart.

It was decided to operate immediately. The udder was inflated with oxygen, and half an ounce of posterior lobe pituitary extract given intramuscularly.

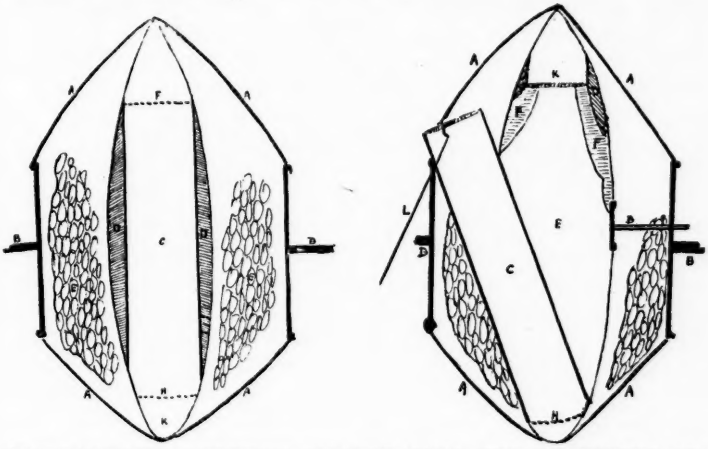
The pericardium contained about half a gallon of very fœtid greenish fluid. The cow could not be made to stand up, and so she was placed on her chest and supported on either side with trusses of straw. At the time of operation air seemed to be inspired into the chest through the wound.

The following day there was apparent a most remarkable change in the cow. She was standing up and feeding. Her coat was "set" as in good health. Her eyes that had appeared sunken the previous day now looked bright and healthy. Yet at the same time a fœtid frothing sero-sanguinous discharge was escaping from the wound. The temperature was 104·2° F., and on no occasion for six weeks did the temperature go below 102° F. During this period the cow continued to feed well and to graze when turned out. The wound, although now half closed up, continued to emit a discharge. The latter was unpleasant until soap pessaries were placed into the pericardial sac. The owner at this time developed the peculiar idea that the continual discharge from this wound would so contaminate

his buildings that the other cows would surely abort, and he had the beast butchered.

When the carcass was examined, the right pleural sac contained about a gallon of clear watery fluid. The left pleural sac was normal, but adherent round the wound.

The inner surface of the pericardium showed a number of discrete ulcerated areas which were the cause of the continual discharge through the chest wound. In other respects the carcass was normal.



DIAGRAMMATIC SKETCHES ILLUSTRATING THE TECHNIQUE OF THE OPERATION

FIG. 1.—A, Edge of skin. B, Retractors. C, Rib. D, Intercostal muscles. E, Severed pectoral muscle. F, Rib severed here. H, Costo-chondral joint. K, Cartilage.

FIG. 2.—A, Edge of skin. B, Retractors. C, Rib deflected by sharp hook. D, Intercostal muscle. E, Pleura covering pericardium. F, Lung (edge). H, Joint severed here. K, Upper segment of severed rib. L, Sharp hook.

In treating this case, the heart was palpated every third day during the first fortnight in removing necrotic material from the pericardial sac, and the only restraint necessary was to hold the cow's horns in order to prevent her from turning round.

CONCLUSIONS.

That the pericardium of the cow can be opened up freely, its interior carefully examined and the heart palpated with comparative safety. That complete recovery may follow such a procedure as in Case I, and that even if this happy result is not obtained the operation may allow the beast to recover sufficiently to be of use for butchering purposes.

The operation is one that from an economic point of view is of use chiefly in valuable pedigree stock, and even though time may show it to have a comparatively high mortality rate, yet it does at least give the animal a fighting chance for life and subsequent utility.

Literature.

The literature on operative interference for pyopericarditis in animals is very scanty. Moussu (1) described an operation for draining the pericardium through a puncture from the direction of the ziphoid cartilage. This procedure was intended to allow the animal to recover sufficiently to be butchered. Liégnaux recorded a recovery by this method, although it is not clear that the case was one of traumatic pericarditis.

There are several references in medical literature on this subject. Barié and Lebert (2) record a case of pericarditis resulting from œsophageal perforation, caused by a broken-down tuberculous mediastinal gland ulcerating into the pericardium and the œsophagus with formation of a fistula. Periostiotomy performed, but death occurred. Boidin (3) recorded a suppurative pericarditis treated by puncture and pericardiotomy. This, however, terminated in death. Robey (4) recorded a recovery following resection of fourth and fifth cartilages in a case of purulent pericarditis following pneumonia. Davis (5) demonstrated a case one year after pericardiotomy, pointing out complications due to adhesions, etc. The infection in the pericardium followed as a sequel to a septic bone process. Williamson (6) recorded a pericardiotomy performed under local anæsthesia (novocain) with temporary improvement, followed by death after seventeen days. Camac and Pool (7) record a case showing marked improvement until a septic phlebitis supervened. Death on the thirteenth day; operation performed under local anæsthesia. Guillermo and Montoya (8) describe a pericardiotomy under chloroform in a boy of eight years followed by complete recovery. Albrecht (9) describes a case of traumatic pericarditis in a young soldier followed by complete recovery. The foreign body was not found. Jones (10) records an interesting case of traumatic pericarditis in a soldier of thirty-eight years of age, following two shell wounds of chest. Pericardiotomy performed under ether. Twenty-two ounces of offensive fluid and much gas evacuated from the sac. The cavity of the latter flushed out with iodine solution. Subsequent recovery apparently complete, the patient showing no undue sequelæ in cardiac region or elsewhere. Klose (11) reported four cases of traumatic pericarditis in soldiers. One recovered after extrapleural pericardiotomy performed under local anæsthesia. Crabtree (12) described the removal of a bullet

from the myocardium of a soldier. The pericardium contained a large amount of thin pus. Recovery was uneventful. Noble and Vine (13) recorded a case of traumatic pericarditis following the passage of a bullet through the chest of a soldier. Pericardiotomy under chloroform and ether resulted in recovery. Pool (14) describes in detail a case in which pericardiotomy was performed with recovery. Resection of the fifth, sixth, and seventh cartilages performed under ethyl chloride ether anæsthesia. Brooke (15) records a series of cases of pyopericarditis secondary to osteomyelitis of bone. Early pericardiotomy resulted in the recovery of two cases.

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ANEURISM OF THE PLANTAR ARTERY.

By R. Hudson, F.R.C.V.S.,
Retford.

The subject was a shorthorn cow which for ten to twelve months had had an enlarged hind fetlock, and which had not caused any inconvenience up to a week before I was asked to see her, when it began to increase in size, cause pain and lameness.

The fetlock region, both above and below, was swollen round the leg, but particularly on the outside, where it presented a rather well-defined longitudinal swelling about 1½ inches wide. It was warmer than normal, denuded here and there of hair, and fluctuated on pressure. I felt no pulsation, but did not examine particularly for it.

The appearance led me to think that pus was present—a not uncommon condition in cattle from bruising on hard floors.

I prepared for lancing and washing out an abscess cavity, and being rather given to making free incisions and doing as much as

possible at one "go" with cows, I took a sharp scalpel and opened up about 2 inches.

Immediately a wide flow of blood came forth under great pressure, and reached a couple of yards across the floor.

It was evident the loss would soon be serious, and fortunately I had bandages and wool with me which I applied tightly, making them safe with an overlapping of binder twine.

I was in no hurry to remove the dressing, and left it on for over a fortnight, when I was pleased to find the wound safely healed.

Such a heavy flow of blood could not have been maintained by a normal plantar artery, which must have increased in size apart from the local dilatation.

HERMAPHRODITISM IN A DOG.

By T. G. BROWNE, M.R.C.V.S.,
Professor of Anatomy, The Veterinary College of Ireland, Dublin.

Subject.—A Kerry blue terrier, said to be about eight years old.

History.—The animal had only been in the owner's possession a few days when symptoms described as those of difficulty in micturition were observed, and for this reason it was brought to the College clinique. No treatment was found necessary, however, and none was adopted. The owner believed the animal to be a bitch, and got no history of any abnormality or any untoward symptoms having been observed by the previous owner. In fact he had obtained the animal for breeding purposes, but on learning the possibilities in this direction, he had it sent to the Dogs' Home for destruction, where it came under the notice of Mr. F. Heney, M.R.C.V.S., who, recognising the condition to be an interesting one, very kindly had the carcass sent to the College for an examination of the genital organs. No further history of the animal's sexual behaviour or proclivities is available.

To all external appearances when alive the animal was a female, but just within the opening representing the vulvar cleft the extremity of what afterwards proved to be a penis could be seen; in fact, the external appearance seemed to resemble very closely that of a case of hermaphroditism illustrated in *Surgical Diseases of the Dog and Cat* by Hobday, p. 284 (second edition). On digital examination the apparent vulva proved to be in reality a prepuce, since it ended blindly in front where the penis was attached, and here its mucous membrane was reflected on to cover the contained portion of the penis. This portion of the penis, as seen in the prepuce, was almost

similar in appearance to the normal free portion (glans penis) of the penis of the dog, but it was slightly shorter, and it tapered somewhat towards its free extremity, and the (external) urethral orifice was on its ventral aspect. At its attachment within the prepuce it presented a normally developed enlargement or bulbus glandis, but on manipulation no definite increase in size or change in the nature of erection was observed. No other structure representing a clitoris was present. There was no scrotum, but rudimentary teats larger than those usually found in the male were observed.

Post-mortem examination revealed* the following: On opening the abdominal cavity an apparently normal uterus was first encountered, and associated with it were two bodies resembling ovaries in external appearance, but these, on histological examination afterwards, proved to be rudimentary testicles. The left body was oval in shape, a little more than half an inch in length, and placed in the normal position of the left ovary near the extremity of the left horn of the uterus behind the left kidney. Leading from this body was a small tube which formed an elongated convoluted structure, the epididymis (see Fig. 1, B). This latter structure lay along the upper border of the testicle. The tube was then continued to first form a **U**-shaped loop, and later it passed backward between the testicle and the epididymis, to disappear near the anterior extremity of the horn of the uterus, but without opening into this organ. This tube was the vas deferens (see Fig. 1, C).

The right body was much smaller than the left, and was placed in the right inguinal canal. No vas deferens or epididymis in connection with it could be made out, but attached to the peritoneum surrounding it was a strip of striped muscle representing the cremaster muscle, and leading to it was a highly flexuous artery resembling the (internal) spermatic. The extremity of the right horn of the uterus had also been carried down with this body into the inguinal canal.

Microscopic examination of sections from these bodies left no doubt as to the identity of the organs. Those from the left body revealed in parts the general structure of the testicle, with some interstitial cells between the tubules, but no spermatozoa within the tubules could be made out. The greater part of the section, however, consisted of fibrous tissue, the seminiferous tubules being present only in small groups. In the case of the right body no tubules or other gland structure could be found, the sections consisting entirely of fibrous tissue resembling that in the left body.

The uterus (*uterus masculinus*) was of the normal size and shape for an animal which had never been pregnant of the terrier type. The body into which the horns opened normally was separated from

the vagina by a circular ridge or constriction which represented the neck. Uterine broad ligaments were present just as in the normal female, but the right allowed the extremity of the right horn of the uterus and the right testicle to pass down into the inguinal canal.

The vagina presented a remarkable appearance, having become

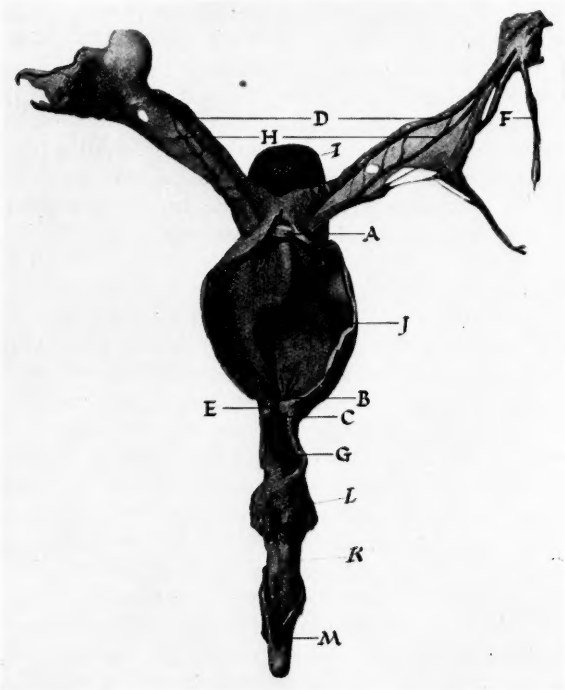

FIG. 1.—Ventral View of Genital Organs of Hermaphrodite Dog after Removal from the Carcass (Dorsal View of Penis).

A, Left testicle. B, Left epididymis. C, Vas deferens. D, Horns of uterus. E, Right testicle. F, (External) Cremaster muscle. G, (Internal) Spermatic artery. H, Uterine arteries in uterine broad ligaments. I, Urinary bladder. J, Vagina (distended). K, Penis. L, Free portion of penis (glans penis). M, Reflection of mucous membrane of prepuce on to the penis.

enormously distended with a mucoid material until it had acquired almost the size and shape of the urinary bladder (see Figs. 1 and 2, J). Posteriorly the vagina opened into the uro-genital passage by two openings, one considerably larger than the other. These probably represent the posterior extremities of the two Müllerian ducts, which apparently for some reason had not here become fused. On the floor of the genital passage, at the level of these two openings, the

opening from the urinary bladder was found, and this was identical in appearance with the opening of the urethra (*meatus urinarius*) normally found on the floor of the vulva of the bitch. That part of the uro-genital passage extending from the latter opening to the ischial arch very closely resembled the intrapelvic portion of the

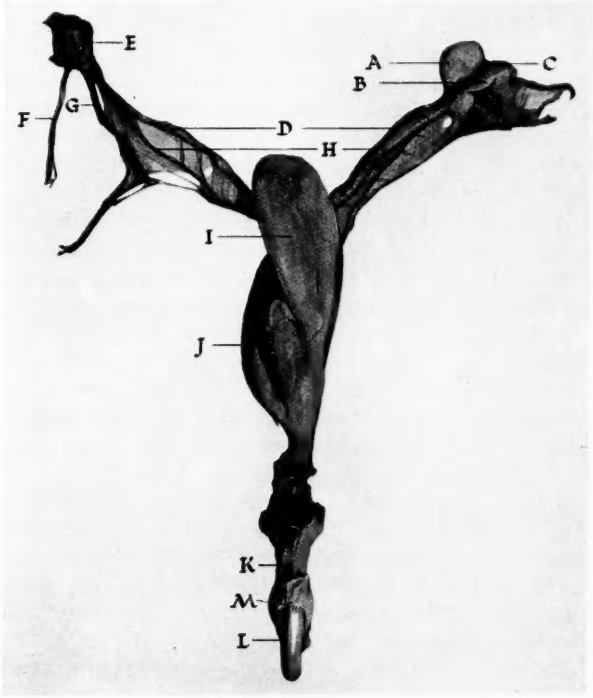

FIG. 2.—Dorsal View of Genital Organs of Hermaphrodite Dog after Removal from the Carcass (Ventral View of Penis). The Neck of the Uterus, the Vagina, and the Intrapelvic Portion of the Urethra have been laid open by a Dorsal Median Incision.

A, Neck of uterus (laid open). B, Smaller opening from vagina into uro-genital passage. C, Opening from urinary bladder. D, Horns of uterus. E, Larger opening from vagina into uro-genital passage (laid open). F, (External) Cremaster muscle. G, Intrapelvic portion of urethra (laid open). H, Uterine arteries in uterine broad ligaments. I, Urinary bladder. J, Vagina (laid open). K, penis. L, Erector penis (ischiocavernosus) muscle. M, (External) Urethral orifice.

urethra of the male dog, and at the ischial arch it became continuous with that portion of the urethra within the penis. No other openings could be made out in this portion of the passage.

No structure which could be called the vulva proper (vestibule

of the vagina) existed, since the urine was carried to the exterior by a tube or male urethra which traversed the length of the penis.

The penis was almost normal in size, shape, and structure, but the free portion (glans penis) was slightly shorter than usual, and it tapered slightly towards its free extremity. The urethral opening (external urethral orifice) was not normally placed, being on the ventral aspect of the glans penis near the free extremity. There was no retractor penis muscle, but the erector penis (*ischiocavernosus*) muscle appeared to be almost normally developed.

No prostate gland could be found.

It will now be evident that the genital organs of this animal were essentially male, but the animal was a cryptorchid, and the *uterus masculinus* had attained the proportions of a well-developed female uterus.

A few cases of hermaphroditism in the dog have been recorded from time to time, and the present one appears to have been very similar to that described by Professor Craig in the VETERINARY JOURNAL of June 1905, p. 313, and illustrated in *Surgical Diseases of the Dog and Cat* by Hobday. Another case of a very similar condition in a bull terrier was described by Ganguly of Calcutta in the *Veterinary Record* of November 3, 1923, p. 803. In that case recorded by Professor Craig, however, the urethra opened into the so-called vulva (or prepuce) beside the rudimentary penis, and did not traverse the length of the penis as in the present case. The fact of the urethra opening beside the penis, however, simply indicates the persistence of an earlier stage in fœtal development, since at one period of development the male urethra opens out beside the glans penis, and it is not until later that a passage through the glans becomes formed.

Before entering into a discussion regarding the probable cause of such abnormalities of the genital apparatus, it is first of all necessary to indicate a few of the most important changes which take place in the normal process of development of the genital organs.

At the early stages of the development of the embryo from the ovum two parallel tubes are formed on each side of the roof of the abdominal cavity. One tube is the Wolffian duct and the other the Müllerian duct. Medial to the anterior extremities of these ducts on either side is a crest called the genital ridge, from which the testicle develops in the male and the ovary in the female. In the development of the male the Wolffian duct of each side forms the epididymis and the vas deferens, while the Müllerian duct aborts to be represented in the adult male chiefly by the rudimentary *uterus masculinus*. In the development of the female, on the other hand, the Müllerian

ducts form the Fallopian tubes and the horns of the uterus, and fuse posteriorly to also form the body of the uterus and the vagina, while the Wolffian ducts atrophy, to be only represented in the adult female by small tubules near the fimbriated extremities of the Fallopian tubes and, in the case of the cow, by the canals of Gaertner on the floor of the vagina.

It may be noted that, during the earlier stages of development of the fœtus, the Wolffian duct of either side acts the part of an excretory tube to the organs (first the pronephros and later the mesonephros or Wolffian body), which represent the kidney of the adult. In the male some of the tubules of the mesonephros or Wolffian body persist and become the vasa efferentia, which establish the connection between the testicle and the epididymis.

The penis in the male and the clitoris in the female develop from an eminence near the ischial arch called the genital eminence. The penis and clitoris are therefore homologous organs.

It will now be apparent that, for a certain period after the process of development of the embryo from the ovum has begun, the male cannot be distinguished from the female. This is the so-called indifferent stage. Very soon, however, either the male or female set of organs predominates and develops, while the other set atrophies; but the factor or factors which exactly determines this predominance is by no means well understood. In regard to the present case of hermaphroditism it would appear that these factors had failed to operate normally, since not only were the male organs developed to a nearly normal degree, but the Müllerian ducts had also developed to form an almost normal uterus and vagina.

In the present state of our knowledge any explanation that may be offered regarding the exact cause of such abnormalities of the genital apparatus can only be a matter for conjecture, at least to a large extent, since, as just stated, the factor or factors which exactly determines the sex of the fœtus and causes either the male or the female set of organs to develop is by no means well understood. It is a well-known fact, however, that once the sex has been determined the development of the female characters depends, at least to a large extent, upon the internal secretion (hormones) from the ovaries, and similarly the development of the male characters depends upon that from the testicles. Furthermore, the hormones in either case act antagonistically to those of the opposite sex. That is to say, those from the male organs prevent the development of the female organs, and vice versa. The female hormones, however, are less antagonistic to those of the male than in the reverse case. Thus we know that when twin calves are of the same sex they are both normal

as regards their genital organs, but when of different sexes the male is always normal, the female rarely so. The explanation is to be found in the fact that, in cases of twin pregnancies in cattle, the two placentæ are usually fused, so that the blood of the two embryos mix and the male sex hormones enter the blood of the female. As a consequence the female becomes, so to speak, " masculinised," or at least its genital organs fail to become fully developed. Such an animal constitutes the so-called " free-martin," which is simply a female modified by male hormones. So far as is known no such fusion of the placentæ ever occurs in any of the other domesticated animals, so that any explanation of hermaphroditism generally on this basis cannot be entertained.

Lipschütz, in the recently published work *The Internal Secretions of the Sex Glands*, states that it is possible to " feminise " a castrated male guinea-pig by an implantation of the ovary and to " masculinise " a castrated female guinea-pig by an implantation of the testicle. In the case of the feminised male the rudimentary teats and mammary glands may not only hypertrophy but secrete milk, and the animal may actually suckle young. On the other hand, the masculinised female, on which a testicular graft has been successful, develops a hypo-spadic penis from the clitoris and a rudimentary prepuce ; also the psycho-sexual behaviour becomes purely male, and the animal follows the females in heat and fights an ordinary male rival.

In the light of this knowledge, that the normal development of the genital apparatus depends on the presence of ovaries in the case of the female and on the testicles in the case of the male, it is only reasonable to assume, in regard to the present case of hermaphroditism, that, since the uterus and vagina were almost fully developed, either ovarian tissue existed and could not be recognised or ovaries had been present and had disappeared.

The Figures illustrate the genital organs as seen after removal from the carcass. For these, I am very deeply indebted to Mr. G. Atkinson, R.H.A., A.R.C.A., Headmaster in the Metropolitan School of Art, Dublin.

Translation

THE VALUE OF A KNOWLEDGE OF FISH DISEASES TO THE VETERINARY PRACTITIONER.*

At the end of the eighteenth century bacterial diseases were known among fish. During the years 1837, 1851, and 1880 there were mass

* A thesis presented by Wolf Raebiger, Veterinary Adviser to the District of Springe, for the degree of Doctor of Veterinary Medicine to the examiners of the Veterinary School of Hanover. *Deutsche T. W.*, p. 513, 32nd year, No. 39.

fatalities among fish in Walfish Bay. Since fish-breeding increased the fish became congregated in smaller space in greater and greater numbers. In breeding and fattening natural feeding was replaced by artificial diet. Through this the power of the subjects to resist disease became less, and the conditions for the transmission and increase of pathogenic bacteria causing epidemics became more favourable. In general fish contain highly bactericidal peculiarities in their blood. Yet there are quite a number of bacteria which are virulent for fish and not a few that are very markedly virulent.

Diseases Caused by Bacteria.

Furunculosis.—This is seen chiefly where salmon trout are artificially reared and fattened and is known as furunculosis of the Salmonidæ. Young and growing fish are most frequently attacked at spawning time, but the disease may occur at other times of the year.

Symptoms.—Intestine and peritoneum are highly inflamed. After this first stage the disease may be noticed strewn about in the deeper parts of the muscular tissue and also diffuse hæmorrhagic spots superficially, which through collapse of the muscular tissue quickly form a furuncle. This then breaks through the skin and forms a superficial ulcer which leads to a fistula into the depths of the musculature. Round about the furuncle there is ecchymosis. Eight to fourteen days after the occurrence of the furuncle the fish dies. Emmerich and Weibel describe the bacterium *Salmonicida* as the cause of this. To avoid this the most scrupulous cleanliness of the water and food is necessary. Clean gravel or sand is recommended in the fish-pond, and never a humus or marshy bottom.

Ruffled Scale of White Fish (*Lepidorthosis contagiosa*).—This is noticed among white fish and was first described by Marianne Plehn, who considered it due to *Bacillus pestis*. To-day ruffled scale is defined as an œdema of the skin, having a weak heart as a direct cause. Kidney congestion may be of some significance. Young carp with coccidial infection of the intestine show a like appearance. It is not an endemic disease. Without bacteriological examination and observation of the internal organs a prognosis cannot be given. The fish, whose scales stand out over the whole body, become weak and generally die. By transposing them into pure running water they may recover. The fish must as far as possible be protected from skin injury.

The Red Plague of Carp (*Purpura cyprinorum*).—This occurs in carp and tench. Through an abnormal dilation and filling up of the bloodvessels, as well as through blood effusions, a red discoloration is caused on the skin of the sides and belly. According to Marianne

Plehn this red plague epidemic is caused by two species of bacteria: (1) *Pseudomonas Plehniæ* Spiekermann and Thienemann, seen in carp and causing general disease. The whole visceral complex is fastened to the belly wall by thready deposits and the body cavity filled with stringy pus. (2) *Bacterium cyprinicida*. This red plague is not so virulent. It is denoted by a form of inflammation of the intestines whereby the mucous membrane becomes eroded with small ulcers in various regions. Frequently the thickened pericardium is adherent to the heart. A certain percentage of the subjects may be cured if placed in pure running water.

The Spotted Disease of Brook Trout (*Morbus maculosus*).—This causes great losses among the American brook trout. Limited and defined spots are found on the skin, which eat away and loosen the outer skin, so that the subcutis is apparent. A severe inflammation of the intestinal canal always accompanies it. Death usually occurs quickly. Its cause is not yet elucidated, but it appears to be an infectious disease.

Tuberculosis of Fish.—Terre and others bred a bacillus from tumours on the fish tail which they called *Bacillus tuberculosis piscium*. It was therefore assumed that the carp had swallowed the sputum of phthisical subjects. The distinction between cold- and warm-blooded bacilli through the microscope is not certain. Others have succeeded in cultivating the bacillus on artificial media. On laboratory animals results have been varied, but all are unanimous that the bacilli of man and cattle tuberculosis do not die in cold-blooded animals, but remain alive for weeks and months, and do not wholly lose their virulence.

Diseases caused through Sporidia.

A second rank of general infectious diseases in fish is due to sporidia. The sporidia of fish belong almost exclusively to the neosporidia. The chief forms affecting fish are: The pock disease of carp (*Epithelioma papulosum*), called also fungus or polypus disease. It occurs in carp and tench reared in ponds, and is noticed in all parts of Germany and Austria. On the skin and fins little translucent milky coloured spots appear which increase in size and then coalesce at different places. Soon the spots spread considerably over the surface and begin to thicken, and thus the diagnosis is certain. Investigation leads to the hypothesis that the disease results from kidney infection with a microscopic parasite (*Myxobolus cyprini* Hofer). The kidney parasite and pox are both very frequently encountered and often in the same fish. Any experimental proof that the pocks are infectious has not been verified. The disease causes immense losses. To combat it, it is recommended that the

pond be run dry, cleaned out and dressed in summer, and thoroughly frozen in winter. These measures are often but not always effective.

Boil Disease of Barbs (*Myxoboliasis tuberosa*).—This has been noticed in the Moselle and its neighbouring tributaries and in the Rhine and Neckar, and in a few weeks has caused the death of tens of thousands of fish. The malady has been studied by Hofer of Telohan. He recognises the *Myxobolus Pfeifferi* as the organism concerned. The barbel show numerous nut to hen egg sized closed or burst boils, which then pass into ulcers. Severely affected fish have straw-coloured flesh. The causal organism is not only found in the boils but also in the muscular tissue and almost all the viscera. The disease occurs in the hot summer months. Sick fish must be systematically collected and a good watch kept, so that they may be detected early and before the boils burst and the spores are liberated.

Special Diseases of Single Organs.

The Diseases of the Skin.—From the different formation of the skin of cold-blooded from that of warm-blooded animals it is clear that the skin of fish is not protected against external influences to the same extent as that of the vertebrates. Although the outer skin and the scabs in the under skin are easily replaced, yet the protection afforded to them does not approach that of the vertebrates living in the air.

Mechanical Injuries.—These arise chiefly in fish from nets and anglers, as also in transport. The injuries are a source of indirect danger to the fish, since they form ports of entry for different bacteria, or otherwise favour fungi attack.

Diseases Resulting from Chemical Actions.—The development of industry leads to chemical changes in the water. The poisonous effect of sulphuric acid is perhaps commonest and worst. In a dilution of 40–100 milligrams it produces a quite pronounced abnormal and violent secretion from the slime cells. Most chemically polluted by waters injure the skin and gills so much that the fish die before the chemicals can produce changes in the internal organs.

Changes of the Skin as a Result of Lack of Oxygen.—This may easily occur during fish transport and when under the ice in a long winter. The fish become markedly pale and die. The colouring matter in the skin becomes drawn together in patches.

Chill Diseases.—The structure of the skin of fish causes them to be very susceptible to changes of temperature. Trout suddenly surrounded by warm water in very cold weather die of apoplexy before any of the usual skin diseases occur. If one therefore transfers fish from one pond to another they must be accustomed slowly to the

colder water. If the fish are chilled it is necessary to return them to warmer water, when in a few days the symptoms of chilling disappear.

PARASITIC SKIN DISEASES.—On the tender fish skin with its slime-like attribute plant and animal parasites easily settle in large numbers. The most frequent and significant parasitic diseases for the fish-breeder are the following :—

Mycosis of Fish due to Saprolegniaceæ.—It is the most frequent and widespread of all diseases of fish, and is noticed in all waters. Less frequent in clear glacial streams than in turbid lower courses of a river or brook. The branching hyphæ of the fungus grow in the skin of the fish, the other parts project like a turf over the surface of the skin. The fungi extend round the fish so quickly that it has little power of resistance. The malady generally leads to the death of the subject.

Animal Parasites. Nodular Disease (*Morbus nodulosis*).—There are quite a number of fisheries where these occur in the leaves and sharplings. Epithelium and cutis die. The parasites are varied in different fish. Fisheries attacked must be run dry and frosted in winter.

Thickening of the Collateral Line is a disease occurring in carp, and causes great thickening and œdema of the collateral line and surrounding epithelium. *Costiasis* occurs chiefly in tench, carp, rainbow trout, goldfish, and fish kept in aquaria. The external skin of the fish becomes discoloured in irregular spots, whose cause is due to the enormous accumulation of *Costia necatrix* Henneguy. It causes slow or quick death.

Of parasitic fish diseases caused by *infusoria*, the most dangerous and widespread is the *ichthyophthirius* disease. It is found chiefly in aquaria and breeding stations, and also especially in carp fisheries. It is denoted by small whitish grey sharply circumscribed, protruding vesicles, which are caused by *ichthyophthirius*. The disease is markedly infectious and leads to death in a few weeks, if not energetically and promptly dealt with.

Worms.—The chief diseases caused by these parasites are the *gyrodactylus* disease, the *diplostomum*, and *leech* disease. The last is noteworthy, in that besides injury to the fish by the suction of the leech, this parasite introduces the blood parasite *Trypanoplasma cyprini*, which causes anæmia and destruction.

The gills of fish can always be affected by mechanical injuries, which make them very susceptible to chemical influences. A quick death as a rule then results. The parasitic diseases of the gills of fish usually accompany similar skin diseases.

Other affections are : Nobby thickening of the gill epithelium (adenocarcinoma), intestinal diseases from various causes, and catarrh

of the gut of young salmon. A great number of these diseases can be combated by prophylactic measures and hygiene. These apply also in salt poisoning and rents of the intestines.

Although the number of fish diseases is not exhausted in this article, yet from it the veterinarian may gain a valuable knowledge of fish diseases. It remains to be stated that—(1) a number of them can be diagnosed by clinical and pathological examination without the help of the laboratory; (2) that in fishable ponds, reservoirs, and aquaria, a course of treatment may be successfully undertaken in costiasis of carp, tench, rainbow trout, and goldfish and other aquarium contained fish, the chilodomasis of carpic fish, the cyclochætiasis of salmon, numerous Cyprinidæ and eels, the diseases caused by sucking-worms, as well as pisciculosis.

For therapy baths in solution of common salt (2–2½ per cent.), salicylic acid (¼ per cent.) and potassium permanganate (1 in 100,000) are used. Chill disease is remedied by transference to warm water.

In all cases where the resident veterinary surgeon cannot establish diagnosis, he should communicate with one of the various veterinary hygienic and bacteriological institutes.

Abstracts of Current Literature

Khan Bahadur C. R. Avari and F. P. Mackie.—Canine Leishmaniasis in Bombay.—*Journal of Tropical Medicine and Hygiene*, February 2, 1925.

A PARIAH dog was noticed to have a superficial sore near the base of one of its ears. Films were made and Leishmania-like parasites were found in fair numbers. The dog was not seen again for some days, and when caught a week later the small lesion was found to have healed, and there only remained a small nodule partly covered by a scab. The nodule was excised and broken up in saline and rubbed into scarifications on the head of a dog and a monkey. No case of Leishmanial infection of Indian dogs has been previously recorded, but this case shows that the disease exists in India.

Kuhn, Dr. Karl.—Petechial Fever in the Dog (from the Clinic for Small Animals, Berlin Veterinary School).—*B.T.W.*, 1924, p. 285.

DESCRIPTION OF THREE CASES OF THE DISEASE.—1. French bull dog, one and a quarter years old, right-sided pneumonia, high fever, weak heart, hæmorrhages from nose and mouth, numerous punctiform

hæmorrhages on mucosa of penis, reddish-brown fæces, blood tinged. On the fifth day sharply defined, dark bluish red spots, the size of a three-mark piece in the unpigmented skin, associated with spontaneous oozing of blood. Erythrocytes in the urine. Swelling of the pharynx, œdematous swelling of the left thigh and under the belly and prepuce. After reduction of the temperature to 101$\frac{1}{5}$° F. a rapid recovery. *Treatment*: Camphorated oil, coffee, intestinal astringents.

2. German mastiff bitch, one and a half years old. On the under surface of the chest and belly and the inner surfaces of the thighs numerous pin-point to lentil-sized hæmorrhages plainly visible on the white skin. Left side of upper lip swollen up and bluish red, chest similarly swollen underneath. The whole of the visible mucous membranes injected and scored with numerous hæmorrhages. Temperature at first 104·9° F., later 100° to 102°. Pulse, 110. Refusal of food and drink. Bloody slime from nostrils. Lungs normal. In urine 0·1 per cent. albumen. In the right chamber of the eye considerable hæmorrhage. *Treatment*: Camphorated oil, ether, suprarenin, 50 c.c. antistreptococcic serum, repeated once. Thereafter considerable improvement. Discharged cured on tenth day. The blood was free from parasites.

3. Mongrel bitch, one and a half years old. Condition similar to 2. Great emaciation and weakness. Conjunctiva of eyelids deep crimson, hæmorrhages into the anterior chamber of the eye on both sides. Temperature 102·2° to 102$\frac{1}{2}$° F. Pulse, 100. Respirations, 32–34; marked vesicular breathing. Numerous erythrocytes in the albuminous urine. Death in four days. No parasites in the blood. *Post-mortem*: Numerous petechial spots in the submucosa, subserosa and subcutis. In the submucosa of the stomach and intestine numerous hæmorrhages, the size of a mark. In the kidneys streaky hæmorrhages. Bladder dark red with a $\frac{3}{4}$ cm. wall. Hæmorrhages under epi- and endo-cardium. Commencing broncho-pneumonia. Pin-point hæmorrhage in the cerebellum. Bone marrow chocolate brown and degenerated. The author begs for reports of similar cases to elucidate the question of petechial fever in the dog.

Roeder, W.—Actinomycosis in the Dog.—*Prag. T.A.*, 1924, vols. 9 and 10, pp. 69–70.

In a three-year-old dog Roeder found a swelling as big as a child's head in the region of the two last ribs on the right side. The skin over the swelling except for a few hairless places was unchanged, the swelling was not movable, and the skin over it only slightly. It was not hot, nor painful, but slight fluctuation was noticed. The swelling was opened up and a quarter of a litre of fluid pressed out, which

was clear, serous, slightly reddish on top when left standing, and with an opaque, yellowish under-layer with numerous gravel-like bodies scattered through it. Bacteriological examination revealed actinomycosis. The wound was packed with iodine tampons and potassium iodide given internally, and cure resulted in one month.

Falk, F.—On the Causes of Impotence in Bulls.—Vet. Med. Inaug. Diss.—Berlin, 1924.—*Archiv für Tierheilkunde*, Vol. 51, pp. 447–461.

FALK has described four different diseases of the genital organs of bulls—anatomically and histologically.

1. Occurrence of calcium concretions in the testicles with azoospermia. There is a primary degeneration of the germ epithelium succeeded by connective tissue formation with deposition of calcium. The cause of this condition is not known. A stasis of semen, which is given by Richter as a cause of this rather frequent condition in billy-goats, could not be established in these cases. Falk considers the view of Richter as improbable.

2. Serous oozing from both testicles as a result of semen stasis which is due to disease of the epididymis. But the cause is not clear. The parenchyma of the testicles is inflamed and inflammatory foci group themselves around the dammed back spermatozoa.

3. Atrophy of the testicles. This is a progressive condition bringing about great destruction of testicular tissue and spermiogenesis, and both testicles soon become affected.

4. Impotentia cœundi, as a result of an abnormal ligament running from the galea glandis ventral to the preputium. The penis was only protrudable about an inch.

Reviews

Annual Report of Proceedings under the Diseases of Animals Acts for the Year 1923. MINISTRY OF AGRICULTURE AND FISHERIES. H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 2s. 6d. net.

This Report is very interesting as it deals in a comprehensive manner with the second year's visitation of foot-and-mouth disease to Great Britain.

The Chief Veterinary Officer states that 207 temporary Veterinary Inspectors had to be added to the staff in order to deal with the outbreaks. The recruiting was difficult, and the necessity for training the men in their duties took up time.

The policy of slaughter was efficiently carried out. Thirty-seven exceptions were made to this procedure; twenty-seven of these were in Cheshire. A Committee of distinguished animal and human pathologists has been appointed by the Minister to conduct research work on foot-and-mouth disease, and the labours of the Committee may be prolonged. (The 1920 Committee gave it as its opinion that investigations should be resolutely pursued for two years at least, and longer if any hopeful results were obtained.—REVIEWER.)

There are a few pages on "Slaughter and Isolation—A Comparison," which the thoughtful man will find pleasure in reading.

From all aspects the disease is discussed, and the fullest knowledge of the malady as it occurs in this country may be gleaned from the pages of the Report.

In Scotland frozen meat from South America was temporarily suspected as the origin of infection. We wonder if hides from South America have ever been suspected as likely causes of sources of infection.

Particulars as to rabies, swine fever, sheep scab, anthrax, glanders, and parasitic mange are recorded in the Report. It is gratifying to note the decrease in mange. This complaint is eminently one that well-directed human effort should eradicate. Seventy-five litres of anti-swine fever serum was distributed from the Weybridge Laboratory in 1923.

Studies Concerning the Handling of Milk. London: H.M. Stationery Office. Price 1s.

This little brochure, of some 47 pages, which is published by the Ministry of Agriculture and Fisheries, should be obtained by every practitioner whose district contains dairies and dairy cattle. It has chapters on milk of every kind, and particularly that of the Grade A (Certified) variety. It is an exceedingly useful and inexpensive aid to knowledge, and particularly valuable at the present time when the public are at last beginning to wake up to the value of a supply of clean milk.

Guide to the Study of Tsetse Flies. By PROFESSOR NEWSTEAD. Pp. 261; 28 plates and 4 maps. The University Press of Liverpool. Price 20s. net.

All veterinarians who are interested in the transmission of disease by flies, and particularly those whose lives are spent in Africa, should obtain this authoritative work. The name of the writer (Professor Newstead, F.R.S.) and his collaborators, Messrs. Evans, Potts, and Stephens, are sufficient guarantee that the work which was taken in hand has been carried through with a completeness and thoroughness which is characteristic. The tsetse fly is dissected and described in the most minute detail, and his habits, his deadly work as a carrier of disease, and all that is known about preventive measures, are to be found in this volume.

It is handsomely bound, and profusely illustrated with coloured plates and photographs, and is in every way a standard work of its kind.

Report of the Bureau of Animal Industry of the United States Department of Agriculture for 1924. By U. G. HOUCK, B.S., V.M.D. Washington, Government Printing Office.

This Report is of particular interest because the Bureau of Animal Industry this year completed its fortieth year of service. It began with

the small staff of a chief, one clerk, and twenty assistants of all classes. At the present time it has grown to such an extent that the Bureau now includes separate departments for Scientific Research, Education, Relieving Animal Suffering, Guarding the Public Health, Promoting the Live Stock Industry, Protecting Property, Stimulating Domestic Commerce in Animals and their Products, and Preserving and Extending Export Trade. There are now nineteen divisions and offices of the Bureau, and the total personnel averages nearly 4,500 employees.

The first big task of the Bureau was the eradication of contagious pleuro-pneumonia, a task in which it succeeded very effectually, and its present triumph in the fortieth year of its existence has been the successful campaign against foot-and-mouth disease in California.

The history of this last foot-and-mouth disease outbreak is very interesting reading to us in England just now. It had spread to no less than sixteen counties, and the magnitude of the outbreak is shown by the fact that in only three months approximately 95,000 animals were involved. In the 1914 outbreak, which was the largest ever experienced in America, and which lasted for a period of eighteen months, 172,000 animals were affected. Had there been no such thing as a well-organised Bureau of Animal Industry, with shrewd, capable, and well-trained veterinary advisers, one cannot but contemplate the ruin which it would have meant to agriculture and the owners of stock.

The Bureau is also divided into divisions which make specialities of animal husbandry, bio-chemistry, dairy work, hog cholera, virus serum, meat inspection, tick eradication, tuberculosis eradication, and a number of others, each with its own special chief, the whole being under the expert supervision of the Chief Veterinarian, Mr. John R. Mohler, whose expert administration has made his name well known to veterinarians all over the world.

Laws, Etc., Relating to Milk and Diaries in Scotland. By ARCHIBALD STALKER. Edinburgh: Wm. Hodge & Co. Pp. 258. Price 12s. 6d. net.

To Veterinary Inspectors who have dairy administration to carry out this book will prove most interesting reading, not only to those whose duties have to be carried out in Scotland, but also to those in England and Ireland who will utilise it as a basis for comparison. It is a complete compendium of all the statues, orders, and instructions on the subject of Milk and Dairies, put together in a convenient form in one cover, the author expressing the hope that it may prove useful to those engaged in the milk industry as well as to those occupied in administrative posts. It fulfils its object well, and is a valuable little book as showing the amount of authority which is possessed by a Veterinary Inspector under the Milk and Dairies Act in Scotland.

Personal

Mr. Amin C. Aggarwala, B.Sc. (Hon.), M.R.C.V.S., a recent graduate from the London Veterinary College, has been appointed Professor of Hygiene and Dietetics in the Punjab Veterinary College, Lahore, India.

Obituary

Edward Lyne Dixon, M.R.C.V.S. By the death of Mr. E. L. Dixon the profession loses one of its most successful practitioners, and the town of Margate one of its most popular professional men. Graduating from the London College in 1878, and settling down at Margate, Mr. Dixon soon established a large and fashionable clientèle, and his name was always foremost in the promotion of anything to do with the veterinary profession and the world of sport.

Generous to a fault, and incapable of doing an underhand action, his friends were many, and the confidence placed in him by his brother practitioners was shown by his unanimous election to the Presidentship of the South-Eastern Counties Veterinary Medical Association, a chair which he occupied with dignity and credit, helping very materially by his personal influence to establish this Society in its present secure position. In Masonic circles he took a very active part, as, indeed, he also did in the social life of the town, and he was fortunate in his later years in having the assistance of his son, Major Leslie Dixon, late of the Royal Army Veterinary Corps, who succeeds him in the practice. Mr. Dixon leaves behind a widow, one son and two daughters, to whom our sympathies are extended in their bereavement.

Sir Thomas Clifford Allbutt, P.C., M.D., F.R.S.; aged 88. Although not a veterinary surgeon, the veterinary profession has lost a good friend and an enthusiastic supporter by the death of Sir Clifford Allbutt, a brilliant member of the medical profession. His honours were numerous and included that of a Privy Councillor. As Regius Professor of Medicine in Cambridge University, he exerted a world-wide influence in the medical world, but to us in the veterinary profession he is best known for the part he took in furthering the study of medical science from a comparative aspect, and it was for this that he was elected as the first Medical President of the Comparative Section of the Royal Society of Medicine, this occurring shortly after he had accepted the Honorary Associateship of the Mid-West Veterinary Association.

His death has taken away a most important link between the two branches of medicine, the human and the veterinary, as his influence in this direction was very great, and his help to consolidate a union between the two was always given in the fullest possible manner.

NOTICES

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